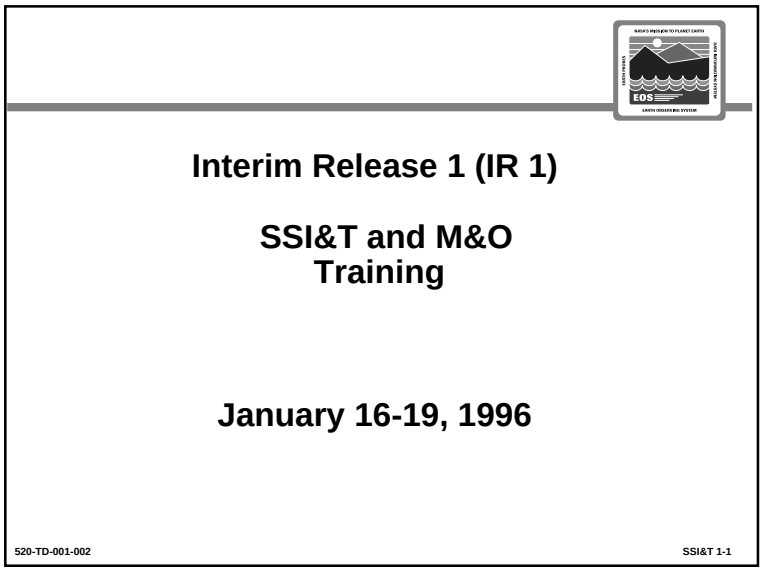


Discussion Topics

Welcome to the Interim Release 1 (IR 1) Science Software and Integration Test (SSI&T) and Maintenance and Operations (M&O) Training course. IR1 of the Earth Observing System Data and Information System (EOSDIS) Core System (ECS) is being deployed at 3 sites beginning January 1996. Interim Release 1 (IR1) serves two major purposes:

1) early interface support and
2) science software support of TRMM (Tropical Rainfall Measurement Mission), a platform scheduled for launch in August 1997 which relies on ECS to support its mission.

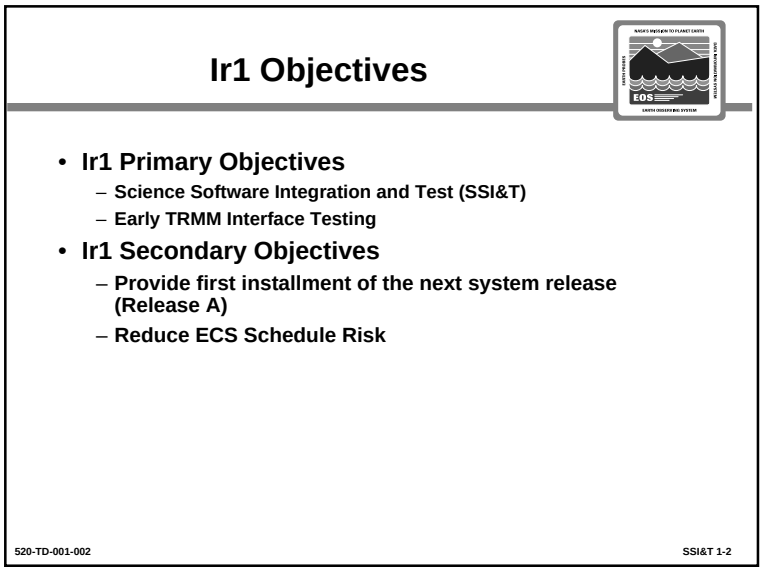
- **Introductions (Karl Cox)**
- **Administrative Announcements**
- **The purpose of this course -- to help SSI&T and M&O personnel:**
  - conduct science software integration and tests
  - test the early TRMM interfaces
  - perform DAAC system management
- **Course format**
  - This course consists primarily of discussion and practical exercises using actual IR1 equipment and software.
  - You will work in small groups of 2-3 people on the exercises, rotating periodically so that each of you can get hands-on experience.
  - The tasks presented will most likely occur in the sequence in which they are performed.
  - The handout you have received consists of the slides and procedures given during the course, and are intended for your use at the DAACs.

References:

609-CD-001-001 *Interim Release One (IR1) Maintenance and Operations Procedures*

MTPE EOS Reference Handbook, Ghassem, A. and Greenstone, R. (Eds.). EOS Project Science Office, NASA/Goddard Space Flight Center, Greenbelt, MD 20771

HP OpenView Network Node Manager User's Guide, Hewlett Packard, Fort Collins, CO, 1993



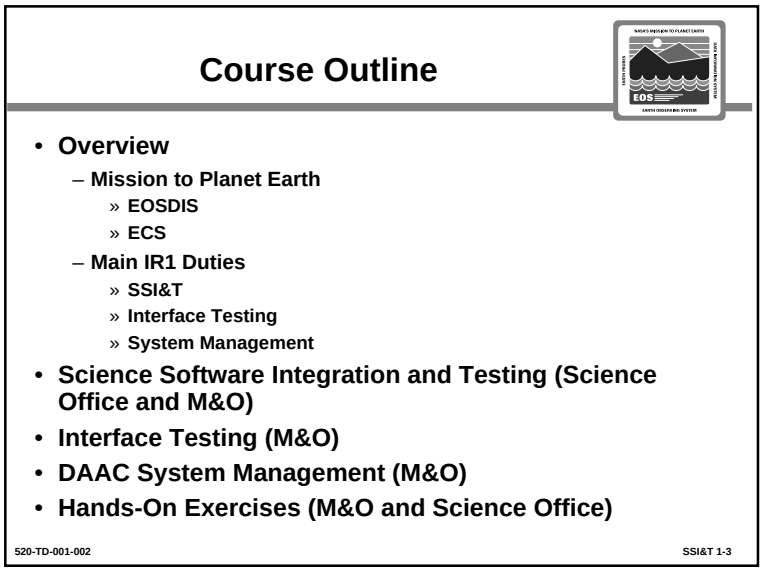
Discussion Topics

Ir1 primary objectives

- Science Software Integration and Test (SSI&T). Ir1 provides an environment for the early integration and testing with ECS of science software being developed by the EOS AM-1 instrument teams and TRMM's CERES and LIS instrument teams. Early SSI&T gives the instrument teams, DAAC personnel and the ECS development team the ability to test the portability of the science software, with success defined by the lessons learned.
- Early TRMM Interface Testing. Ir1 provides capabilities for early functional testing of TRMM-ECS interfaces among several facilities including the Sensor Data Processing Facility (SDPF), the TRMM Science Data and Information System (TSDIS), NOAA/ NESDIS, the Data Assimilation Office (DAO), and three DAACs - LaRC, GSFC and MSFC.

Ir1 Secondary Objectives

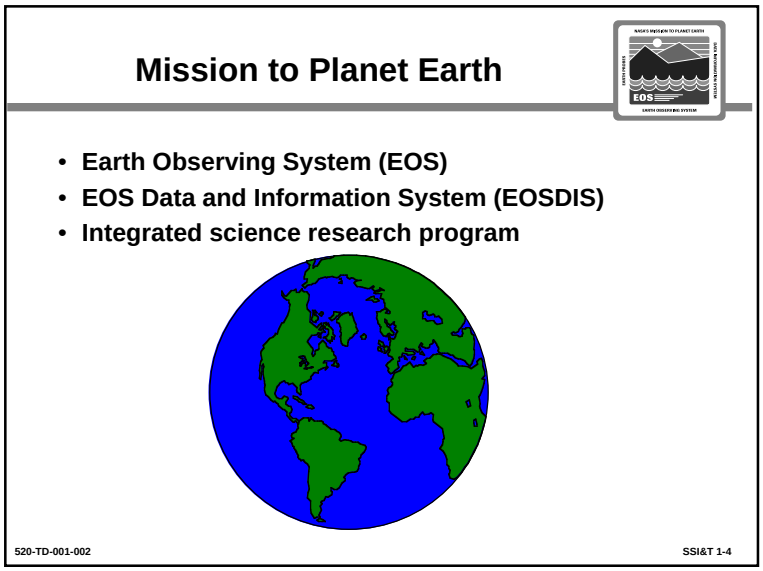
- Ir1 provides the first installment of the next system release (Release A). It provides basic system hardware and software that is used in Release A.
- Reduce ECS Schedule Risk. Ir1 provides essential lessons-learned and shakedown of ECS internal processes and hand-offs ahead of Release A. These processes include:
  - Science software I&T processes
  - Procurement, development, system I&T
  - System assembly, shipping, and installation
  - Resource Management
  - External coordination with all the players (e.g., SCFs, DAACs, EDF)



Discussion Topics

Course Outline

- Overview
  - Mission to Planet Earth
    - » EOSDIS
    - » ECS
  - Main IR1 Duties
    - » SSI&T
    - » Interface Testing
    - » System Management
- Science Office Integration and Testing (Science Office)
- Interface Testing (M&O)
- DAAC System Management (M&O)
  - System Management Tools
    - » interface test
    - » SSI&T
    - » Infrastructure
- Hands-On Exercises (M&O and Science Office)
    - » SSI&T specific (e.g., integrate, evaluate, and test the science software)
    - » M&O specific (e.g., operate the system, perform maintenance, support SSI&T)
    - » Both SSI&T and M&O working together



Discussion Topics

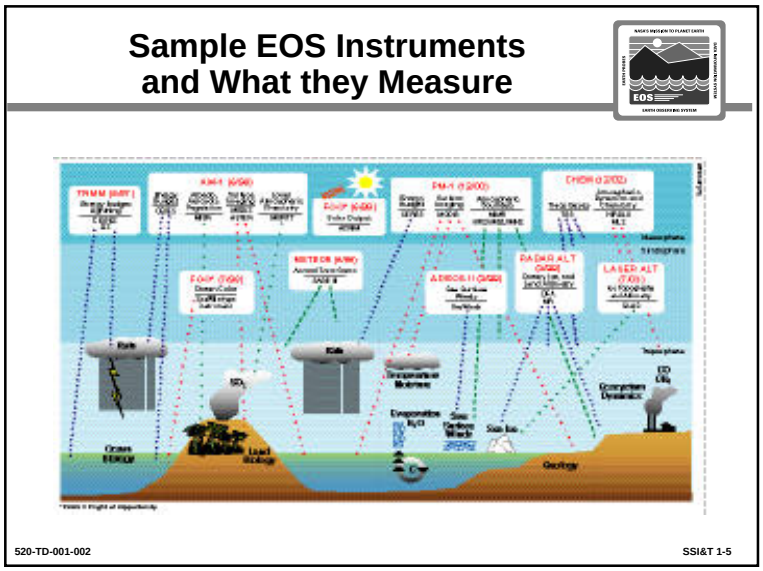
Introduction

The Mission to Planet Earth (MTPE) is a long-term, multi-disciplinary, and inter-disciplinary NASA research mission that uses space, ground- and aircraft-based measurement systems to allow:

- studying the processes leading to global climate changes
- development of a predictive capability for earth systems on time scales of decades to centuries.

Components of EOS

- the Earth Observing System (EOS) collects earth science data, with emphasis on long-term, sustained data sets from carefully calibrated instruments on satellites in low Earth orbits
- the EOS Data and Information System (EOSDIS) provides the earth science community with easy, affordable, and reliable access to EOS and other earth science data
- an integrated scientific research program investigates processes in the earth system and uses this information to improve predictive models



Discussion Topics

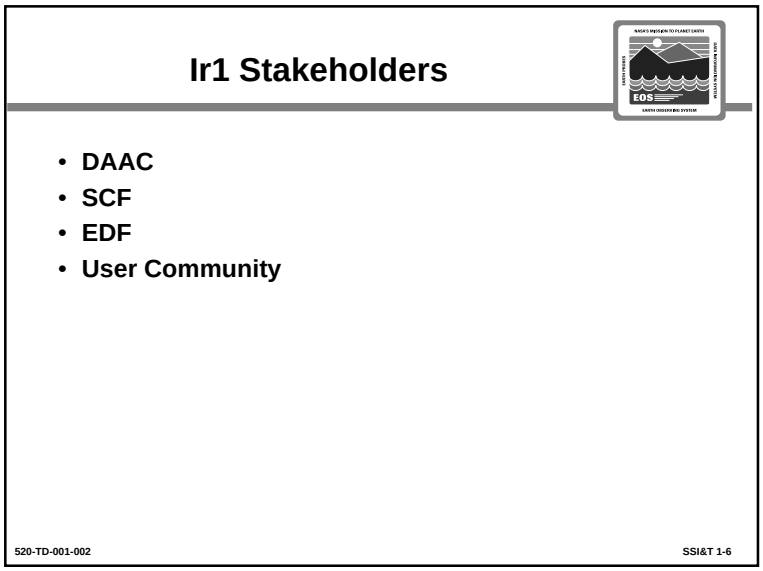
Goal of EOS

To determine the extent, causes, and regional consequences of global climate changes.

- Planning for the EOS mission began in the early 1980s
- Early 1990, NASA announced the selection of 30 instruments to be developed for EOS.
- 29 interdisciplinary science teams were also selected.

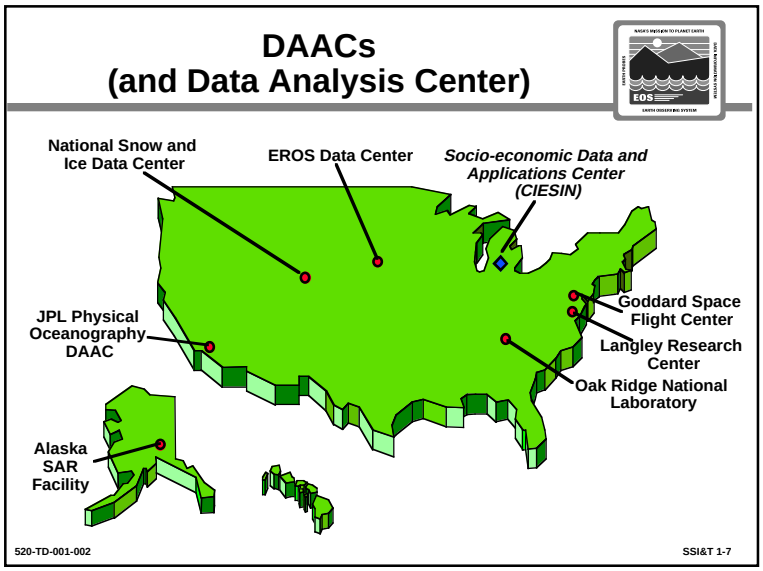
EOS instruments:

- provide long-term collection of data
- allow for measurement of Earth over the long-term to help detect climate changes and reasons for those changes
- data collected using these instruments will be the first “new” data; this will be in addition to the DAACs (V0) historical data.



Discussion Topics

- Distributed Active Archive Centers (DAAC)
- Science Computing Facilities (SCF)
- ECS Development Facility (EDF)
  - The EDF is configured to support the DAAC and SMC capabilities associated with the development, test and sustaining engineering for Ir1.
- The EOSDIS user community
  - NASA-supported researchers
  - Educational institutions
  - other scientific, resource management, and policy communities.



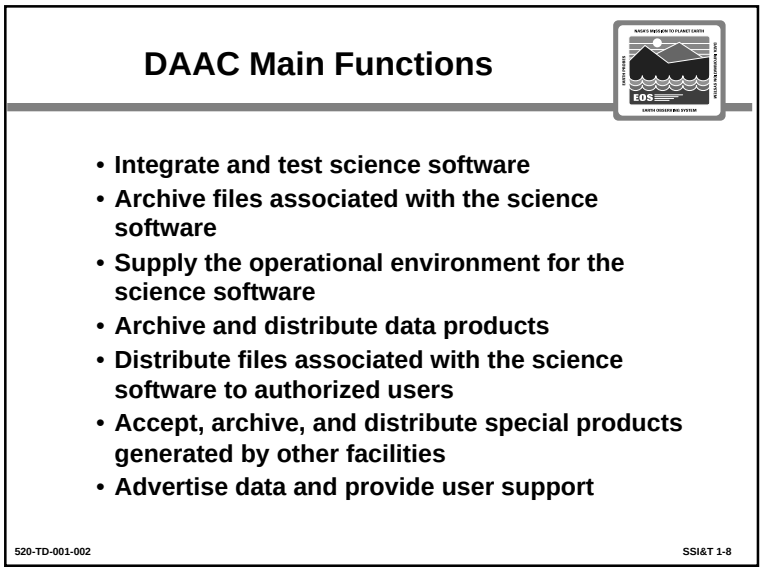
Discussion Topics

Distributed Active Archive Centers (DAACs). It is the goal of EOSDIS to provide end-to-end services from EOS instrument data collection to science data processing to full access to EOS and other Earth science data holdings. Seven DAACs across the U.S. process, archive, and distribute EOS and related data, and provide a full range of user support. The DAAC and the Data Analysis Center (DAC) act as a link between the EOS program and the user community. IR1 is deployed at 3 DAACs:

- Goddard Space Flight Center (GSFC)
- EROS Data Center (EDC)
- Langley Research Center (LaRC)
- Note: Ir1 is also deployed at the ECS development facility (EDF).

The DAACs chosen by NASA demonstrated expertise in specific disciplines and long-term commitments to the corresponding user communities.

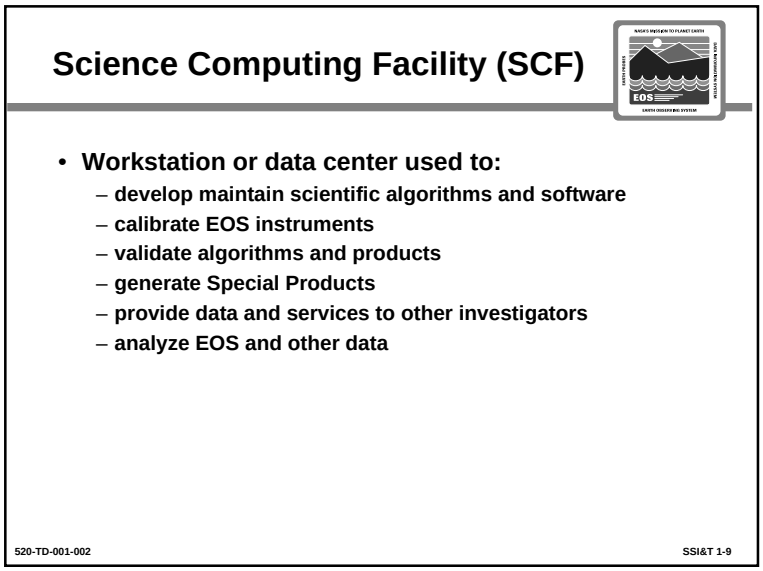
- The DAACs provide the facilities, the management and operations support for the production, archive, and distribution of EOS Standard Products.
- At the DAACs, users can expect a level of service which would be difficult to maintain in a single data center attempting to serve the extraordinarily wide range of scientific disciplines encompassed by the EOS program.
- A user interacting with any given DAAC can access data from all the DAACs.



Discussion Topics

DAAC main functions:

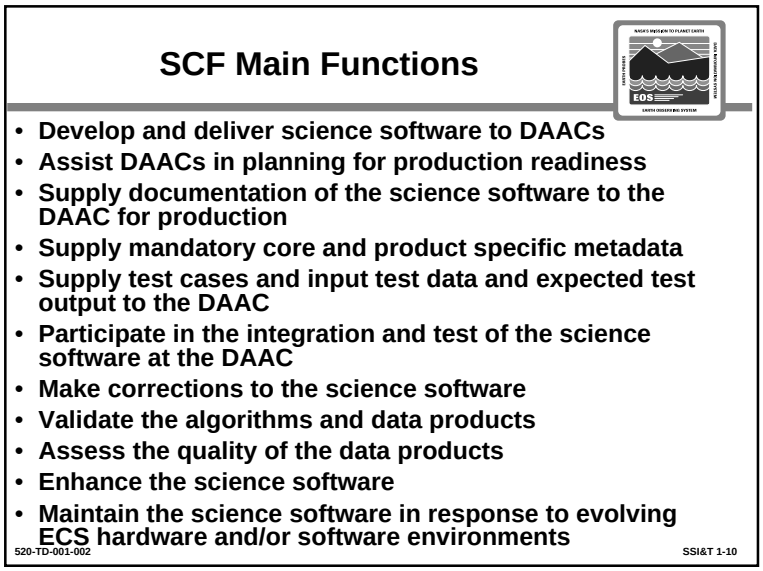
- Integration and test of the science software, in order to verify that the software will run properly, i.e., will not interfere with other software or DAAC operations. The integration and test activity will also allow the SCF to verify that the software will run correctly (i.e., produce scientifically correct results) in the production environment.
- Archiving all source files, documentation, test information, and other files associated with the science software.
- Supplying the operational environment for the science software and running the software in an ongoing production mode to generate the data products.
- Archiving and distributing the data products.
- Distributing source files, documentation, test information, and other files associated with the science software to authorized users.
- Accepting, archiving, and distributing special products generated by other facilities.
- Advertising data and providing user support.



Discussion Topics

Science Computing Facility (SCF). The SCF is the location where the science software is developed.

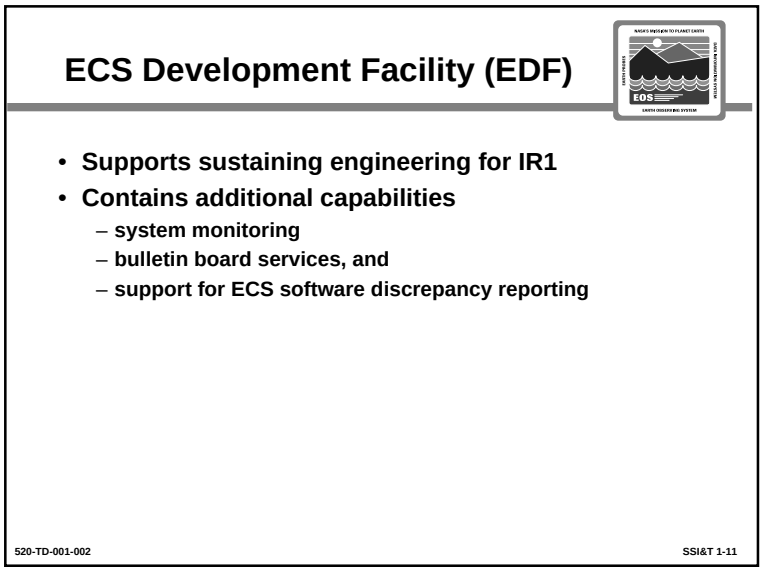
- SCFs, located at EOS investigators' home institutions, are used to develop and maintain scientific algorithms and software, calibrate the EOS instruments, validate algorithms and products, generate Special Products, provide data and services to other investigators, and analyze EOS and other data in pursuit of the MPTE science objectives.
- The SCFs are established directly by the EOS investigators, and may consist of a single workstation or a large data center.
- Software toolkits are provided to the SCFs and other users to facilitate data access, transformation and visualization, and for algorithm development.
- The developer may reside at the SCF, or may deliver software to the SCF for integration with other software before delivery to the DAAC.



Discussion Topics

SCF main functions:

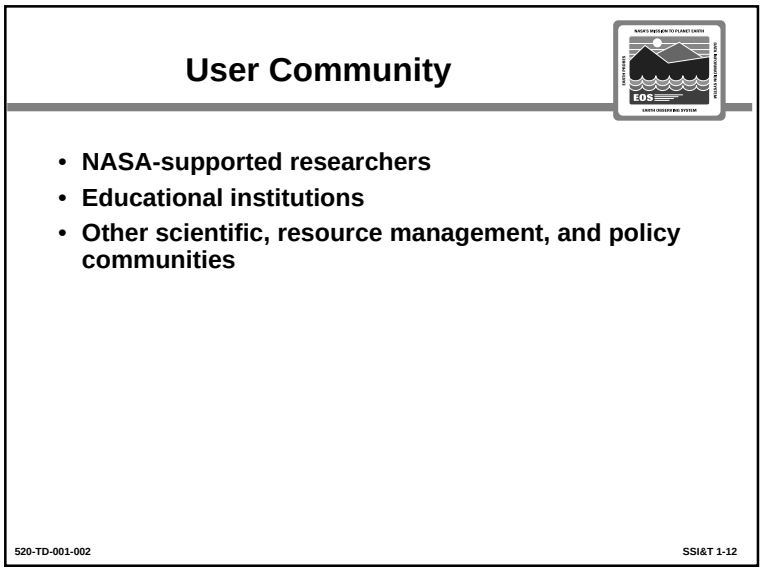
- Developing the science software and delivering it to the DAAC.
- Assisting the DAAC in planning for production readiness, including the integration and test of the science software.
- Supplying documentation of the science software to the DAAC for production, to serve as an archived record in case maintenance responsibilities later are transferred to someone else, and as information for users to determine that the data meets user requirements.
- Supplying the mandatory core and product specific metadata
- Supplying test cases and input test data and expected test output to the DAAC in order to verify that the software runs correctly in the operational environment.
- Participating in the integration and test of the science software at the DAAC, in particular the evaluation of the results of integration and test.
- Making corrections to the science software that are indicated by integration and test at the DAAC.
- Validating the algorithms and data products.
- Assessing the quality of the data products.
- Enhancing the science software.
- Maintaining the science software in response to evolving ECS hardware and/or software environments.



Discussion Topics

ECS Development Facility (EDF). The EDF, located at HITC in Landover, MD, supports sustaining engineering activities for Ir1.

- In addition, the EDF hosts IR1 capabilities and supporting equipment which support the DAACs but are unique to the EDF. These capabilities include:
  - system monitoring
  - bulletin board services, and
  - support for ECS software discrepancy reporting.



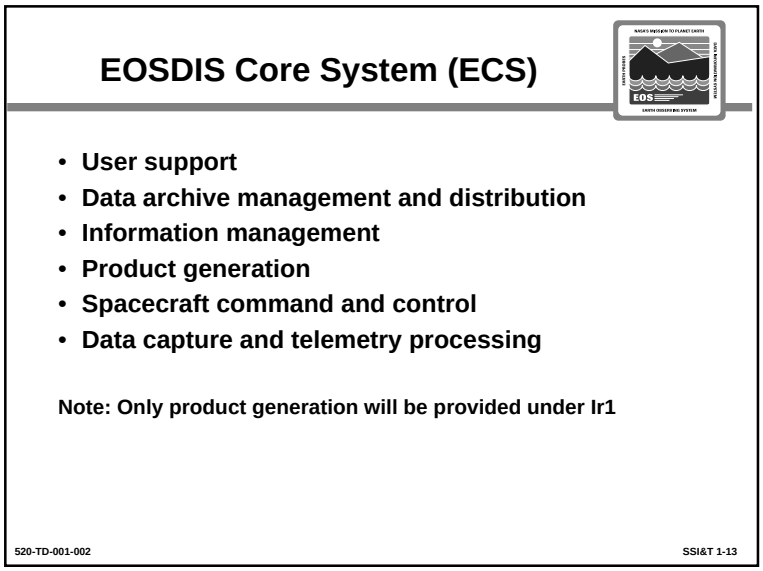
Discussion Topics

The user community(long-term).

- NASA-supported researchers,
- Educational institutions
- other scientific, resource management, and policy communities.

In IR1, the user community consists of:

- Instrument teams
- DAACs
- Science personnel



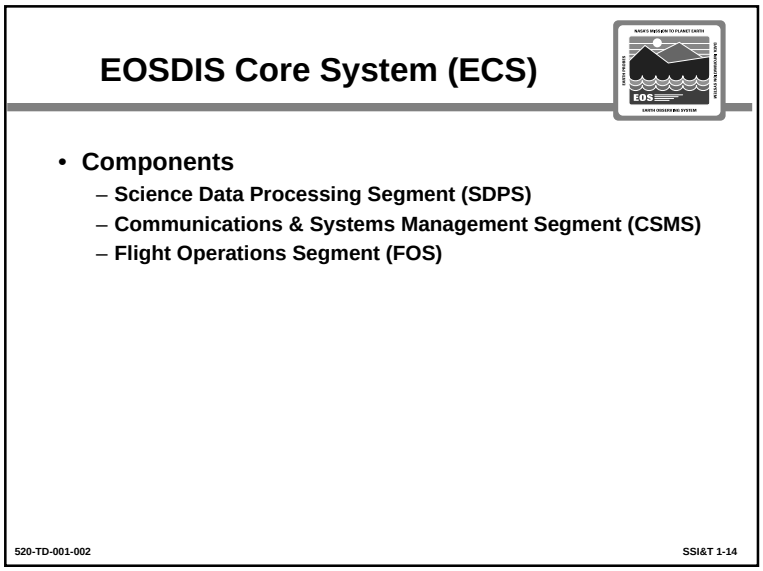
Discussion Topics

EOSDIS is a comprehensive data and information system that provides a variety of services for both the casual user and for selected NASA research scientists. Services include:

- **User Support**. Users interact with EOSDIS via DAACs using human machine interfaces. The DAACs assist users in data acquisition, search, access , and usage.
- **Data Archive Management and Distribution.** EOSDIS will store all standard and special products computed form EOS and non-EOS instruments and distribute requested information to users electronically. Other information such as product generation algorithms, software, documentation, calibration data, engineering, and other ancillary data are stored and provided to users upon request.
- **Information Management.** EOSDIS provides an intuitive system that provides convenient mechanisms for locating and accessing subsets of products of interest. EOSDIS provides an extensible set of tools and capabilities that allow investigators to provide access to special products from their own computing facilities.
- **Product Generation.** Beginning with TRMM in 1997, EOSDIS will support data product generation from EOS instrument observations.
- **Spacecraft Command and Control.** EOSDIS will perform spacecraft and instrument planning and scheduling, and command and control.
- **Data Capture and Telemetry Processing.** EOSDIS will be able to capture data from all EOS spacecraft and process them to remove telemetry errors, eliminate any artifacts, and create Level 0 data products that are “raw” data as measured by the instruments.

The EOSDIS Core System (ECS) is the major component of the EOSDIS. The main functions of ECS are:

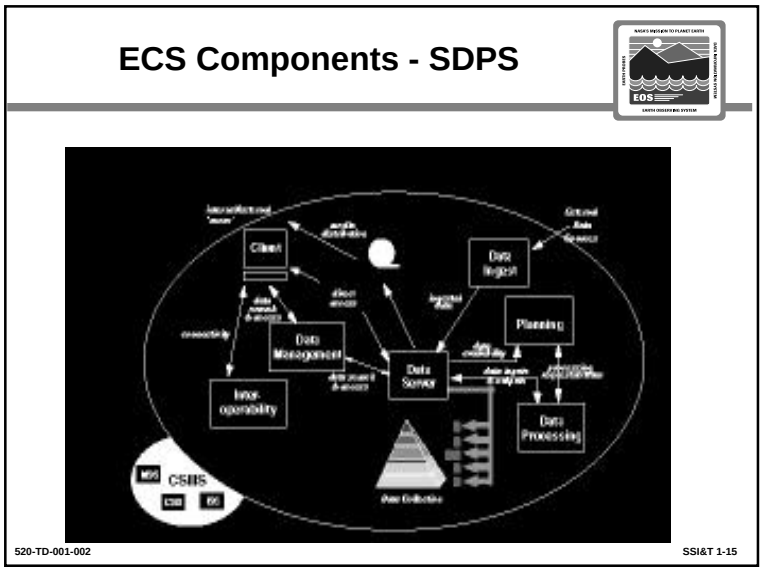
- control the EOS spacecraft and instruments
- process data from the EOS instruments
- manage and distribute EOS data products and other selected data sets to the scientific community



Discussion Topics

The major functional components/segments of the ECS program:

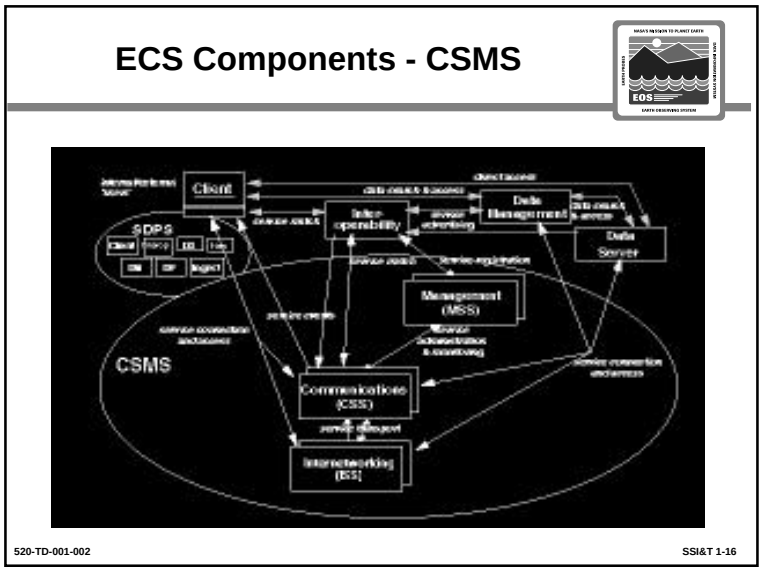
- **The Science Data Processing Segment (SDPS)** receives, processes, archives and manages all data from EOS and other NASA Probe flight missions. It provides support to the user community in accessing the data as well as products resulting from research activities that utilize this data. SDPS also promotes, through advertisement services, the effective utilization and exchange of data within the user community. Finally, the SDPS plays a central role in providing the science community with the proper infrastructure for development, experimental usage and quality checking of new Earth science algorithms. SDPS is a distributed system and its components are currently planned to be located at eight Distributed Active Archive Centers (DAACs).
- **The Communications and System Management Segment (CSMS)** focuses on the system components involved with the interconnection of user and service providers and with system management of the ECS components. The CSMS is composed of three major Subsystems:
  - Communications Subsystem (CSS)
  - Internetworking Subsystem (ISS), and
  - System Management Subsystem (MSS).
- **The Flight Operations Segment (FOS)** manages and controls the EOS spacecraft and instruments. The FOS is responsible for mission planning, scheduling, control, monitoring, and analysis in support of mission operations for US. EOS spacecraft and instruments. The FOS also provides investigator-site ECS software to connect a Principal Investigator (PI) or Team Leader facility to the FOS in remote support of instrument control and monitoring. PI/TL facilities are outside the FOS, but connected to it by way of the EOSDIS Science Network (ESN).



Discussion Topics

SDPS Subsystems. SDPS is composed of 7 subsystems that can be grouped into 4 main categories:

- **Data Storage and Management** as represented by the Data Server Subsystem (DSS), provides the functions needed to archive science data, search for and retrieve archived data, manage the archives, and stage data resources needed as input to science software or resulting as output from their execution.
- **Data Search and Retrieval** (also called the "Data Pull Side" of the system) is represented by the science user interface functions in the Client Subsystem (CLS), data search support functions in the Data Management Subsystem (DMS), and capabilities in the Interoperability Subsystem (IOS) which assist users in locating services and data of interest to them and their projects.
- **Data Processing** (considered a part of the "Data Push Side" of the system) is represented by a processing environment (the Data Processing Subsystem or DPS) for the science software; and capabilities for long and short term planning of science data processing, as well as management of the production environment provided by the Planning Subsystem (PLS).
- **Data Ingest** (also considered part of the "Data Push Side") is represented by the Ingest Subsystem (INS). The subsystem provides the interfaces with external applications, data staging capabilities, and storage for an approximately 1-year buffer of Level 0 data (so that reprocessing can be serviced from local storage).

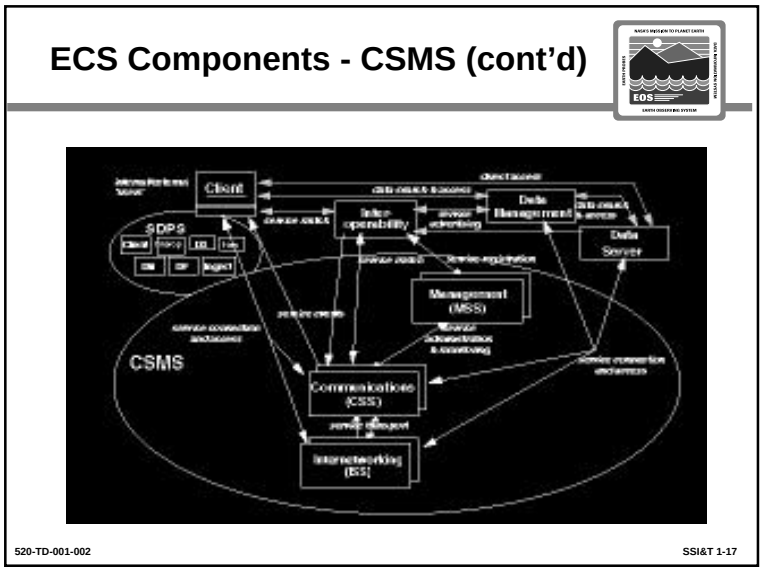


Discussion Topics

CSMS Subsystems. CSMS is composed of 3 subsystems:

Communications Subsystem (CSS)

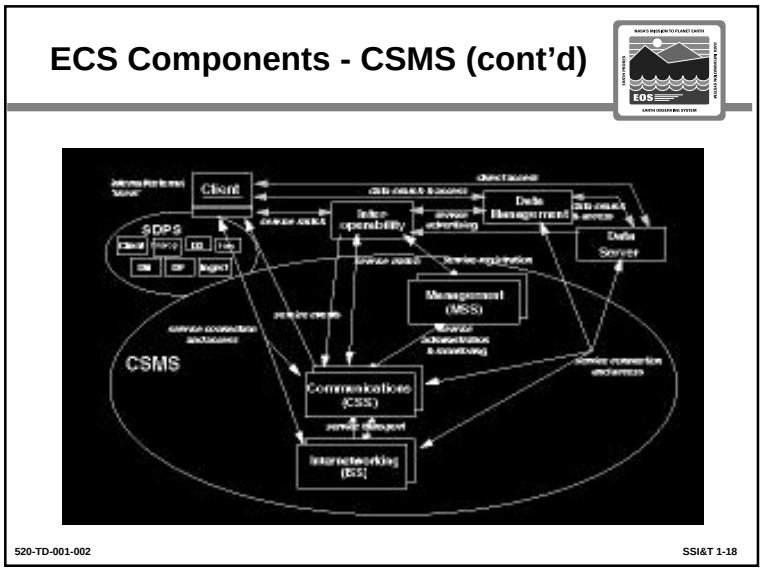
- CSS plays a key role in the interoperation of the SDPS subsystems. SDPS applications follow an object-oriented design. That is, their lowest level software components are "software objects". SDPS also implements a distributed design, that is, its components - the software objects - are distributed across many platforms at a given site, and across several sites. For the software objects to communicate with each other requires "distributed object" communications environment. This environment is provided by CSS, using off-the-shelf technology with some custom software. The environment allows software objects to communicate with each other reliably, synchronously as well as asynchronously, via interfaces which make the location of a software object and the specifics of the communications mechanisms transparent to the application.
- In addition, CSS provides the infrastructural services for the distributed object environment. They are based on the Distributed Computing Environment (DCE) from the Open Software Foundation (OSF). DCE includes a number of basic services needed to develop distributed applications, such as remote procedure calls (RPC), distributed file services (DFS), directory and naming services, security services, and time services.
- Finally, CSS provides a set of common facilities, which include legacy communications services required within the ECS infrastructure and at the external interfaces for file transfer, electronic mail, bulletin board and remote terminal support. The Object Services support all ECS applications with interprocess communication and specialized infrastructural services such as security, directory, time, asynchronous message passing and event logging. The Distributed Object Framework is a collection of a set of core object services, collectively providing object-oriented client server development and interaction amongst applications.



Discussion Topics

Management Subsystem (MSS)

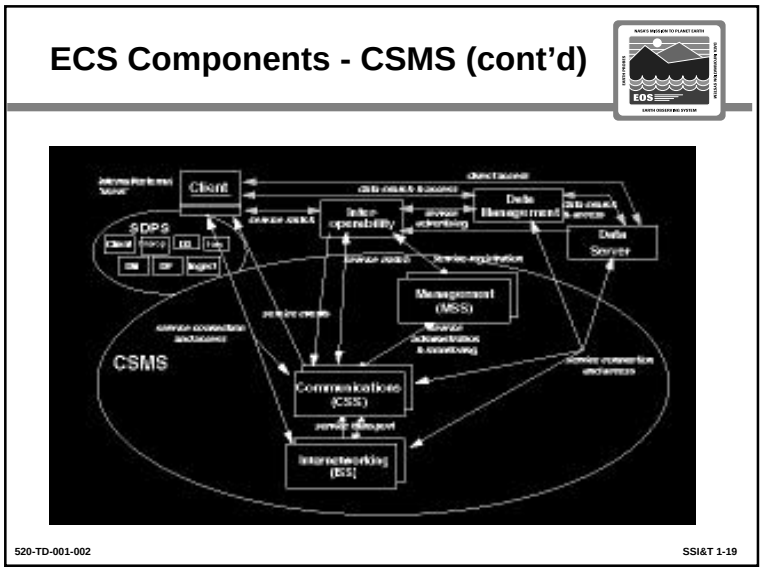
- The Management Subsystem (MSS) provides enterprise management (network and system management) for all ECS resources: commercial hardware (including computers, peripherals, and network routing devices), commercial software, and custom applications. With few exceptions, the management services will be fully decentralized, such that no single point of failure exists which would preclude the system from continuing to operate or system operations and management to come to a halt.
- However, MSS does provide two levels of an ECS management view: the local (site/DAAC specific) view is provided by Local System Management (LSM), and the enterprise view is provided by Enterprise Monitoring and Coordination (EMC) at the SMC, located at Goddard Space Flight Center (GSFC).
- Enterprise management relies on the collection of information about the managed resources, and the ability to send notifications and commands to those resources. For network devices, computing platforms, and some commercial of the shelf software, MSS relies on software called "agents" which is usually located on the same device/platform and interacts with the device's or platform/s control software, or the commercial software product.
- However, a large portion of the ECS applications software is custom developed, and some of this software - the science software - is externally supplied. For these components, MSS provides a set of interfaces via which these components can provide information to MSS (e.g., about events which are of interest to system management such as the receipt of a user request or the detection of a software failure), and or can take commands from MSS provided to MSS from M&O consoles (e.g., an instruction to shut down a particular component).
- Applications which do not interact with MSS directly will be monitored by software which acts as their "proxies". For example, the Data Processing Subsystem (DPS) acts as the proxy for the science software it executes. It notifies MSS of events such as the dispatching or completion of a PGE, or its abnormal termination.



Discussion Topics

Management Subsystem (MSS) (cont'd)

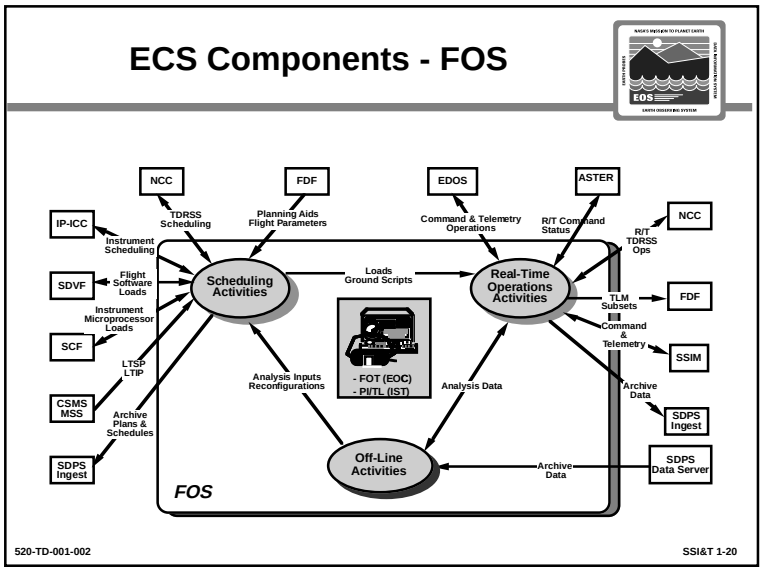
- ECS selected HP OpenView as the centerpiece of its system management solution, and is augmenting it with other commercially available "agents", as well as custom developed software (e.g., the applications interfaces mentioned above). The information collected via the MSS interfaces from the various ECS resources is consolidated into an event history database on a regular basis (every 15 to 30 minutes) as well as on demand, when necessitated by an operator inquiry. The database is managed by Sybase, and Sybase query and report writing capabilities will be used to extract regular and ad-hoc reports from it. Extracts and summaries of this information will be further consolidated on a system wide basis by forwarding it to the SMC (also on a regular basis).
- MSS also provides other general system management functions, such as security management (providing administration of identifications, passwords, and profiles), and configuration management for ECS software, hardware, and documents.



Discussion Topics

Internetworking Subsystem (ISS)

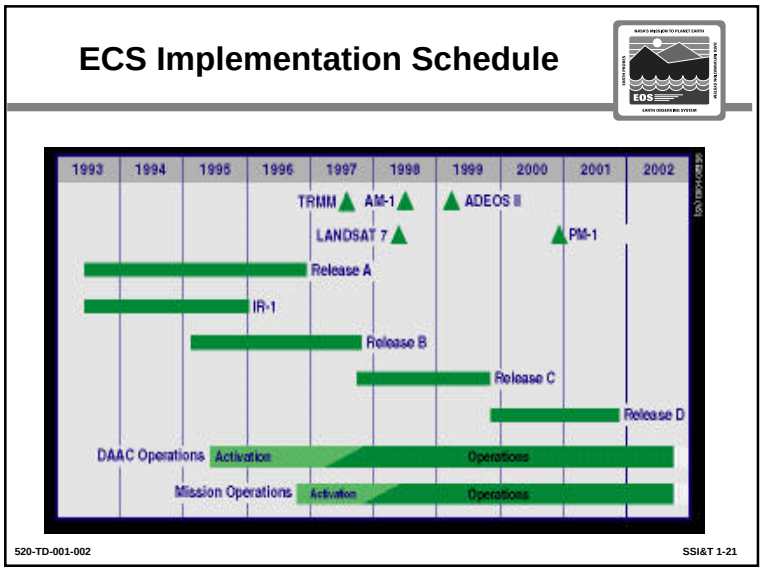
- The ISS provides local area networking (LAN) services at ECS installations to interconnect and transport data among ECS resources. The ISS includes all components associated with LAN services including routing, switching, and cabling as well as network interface units and communications protocols within ECS resources.
- The ISS also provides access services to link the ECS LAN services to Government-furnished wide-area networks (WANs), point-to-point links and institutional network services. Examples include the NASA Science Internet (NSI), Program Support Communications Network (PSCN), and various campus networks "adjoining" ECS installations.



Discussion Topics

Flight Operations Segment (FOS)

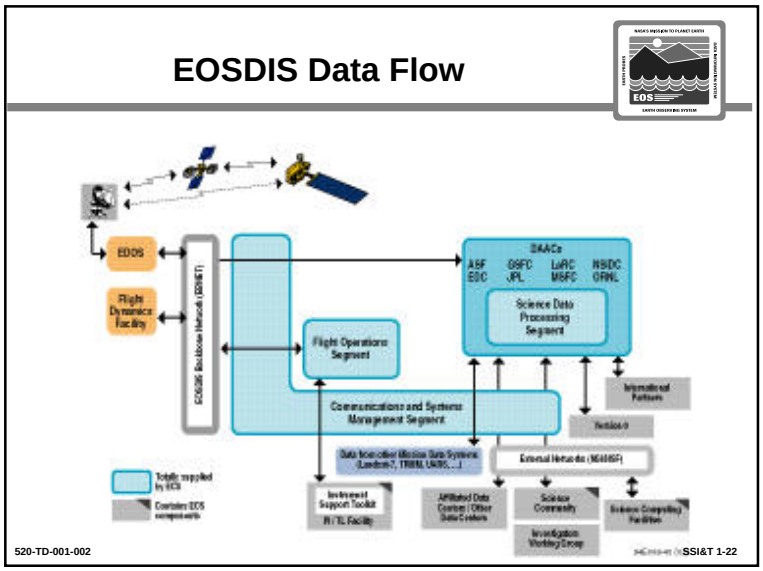
- Manages and controls the EOS spacecraft and instruments.
- FOS is responsible for mission planning, scheduling, control, monitoring, and analysis in support of mission operations for U.S. EOS spacecraft and instruments.
- FOS also provides investigator-site ECS software to connect a Principal Investigator (PI) or Team Leader facility to the FOS in remote support of instrument control and monitoring. PI/TL facilities are outside the FOS, but connected to it by way of the EOSDIS Science Network (ESN).



Discussion Topics

The schedule on the slide shows the timetable for:

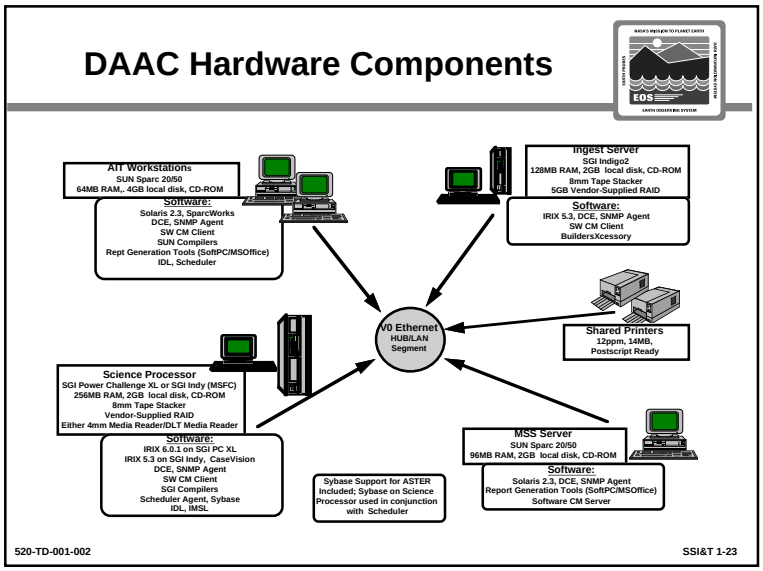
- Launches of TRMM, LANDSAT 7, AM-1, ADEOS II, PM-1
- IR-1 and Releases A-D
- DAAC Operations
- Mission Operations



Discussion Topics

What happens to the data when it's transmitted from EOS satellites:

- In general, NASA EOS satellites nominally transmit their instrument data in a single, combined telemetry stream through the Tracking and Data Relay Satellites (TDRS) to the receiving station at White Sands, New Mexico.
- The data are then processed by the EOS Data and Operations System (EDOS) to recover the raw, Level 0 instrument data. (Satellites operated by international partners, however, downlink directly to the appropriate International Partner Ground System (IPGS) via their receiving stations. Data from an IPGS are typically transferred directly to the DAAC via media or other electronic means.
- The Level 0 instrument data are then distributed to the designated DAACs. The DAACs house the ECS computing facilities and operational staff needed for product generation and to manage and store EOSDIS data, as well as the associated metadata and browse data required for effective use of the data holdings.
  - When necessary, the DAACs exchange data via a dedicated EOSDIS backbone network (EBNET) to receive data products generated at other DAACs which it needs as inputs to its own processing.
  - The DAAC likewise distributes the data products which it produces to other DAACs which need those products as inputs.
- Most science users access EOS data products via external networks such as: NASA Science Internet (NSI) or National Science Foundation (NSF) Internet.
  - Open access to the EOS data by all members of the science community distinguishes the EOS from previous research satellite projects, where selected investigators have had proprietary data rights for a number of years after data acquisition.
- The DAAC receives requests for data products and other archived information from the users, and distributes the requested data.
- The DAAC receives data products from non-EOS suppliers such as the National Oceanic and Atmospheric Administration (NOAA) when these products are required as inputs to the DAAC's processing. These data are called “ancillary data.”

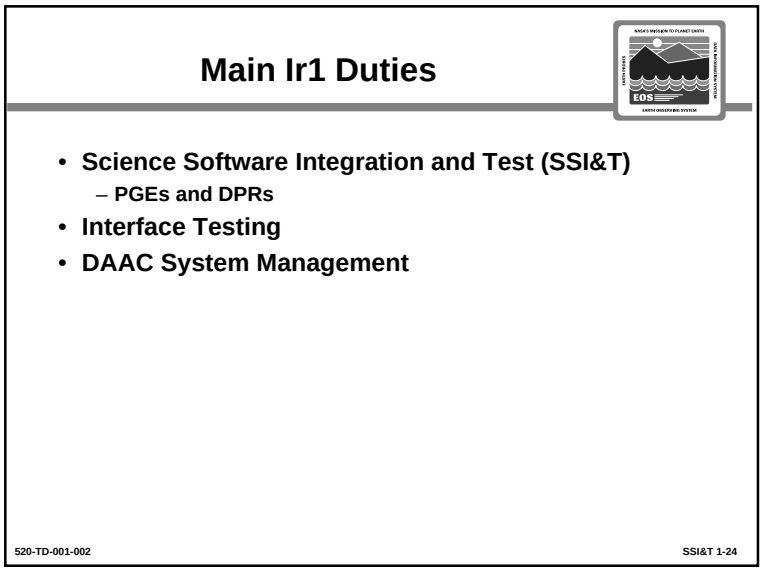


Discussion Topics

The major hardware components of IR1 at the EDF and DAACs. The configurations and capabilities of IR1 at the EDF and three DAACs are similar, with exceptions noted.

- **Ingest Server.** SGI Indigo2 computer used to support ingest interface testing. Hosts ingest interface software. The Ingest Server is provided at the GSFC, and LaRC DAACs but not at the EDC DAAC.
- **Science Processor.** Hosts the IR1 prototype Planning and Data Processing capability. It serves as a platform for integrating (checking, compiling, linking) and dynamically testing the Science Software developed by ECS instrument teams. An SGI Power Challenge XL resides at the GSFC, LaRC, and EDC DAACs.
- **SSI&T Workstations.** Two SUN Sparc 20/50 workstations function as SSI&T workstations. They serve as adjuncts to the Science Processor for the purpose of supporting more static processes associated with the integration and test of science software. One of the workstations has upgraded hardware capabilities and serves as a host for the Planning and Data Processing scheduler and for the Planning and Data Processing database.
- **Database Server.** The Database Server is the upgraded SSI&T workstation. The Database Server hosts two Sybase databases. One database is used by the Planning and Data Processing scheduler; the other database is the Planning and Data Processing PGE database. At the EDC DAAC, the Database Server hosts the ASTER database, which is also implemented with the Sybase .
- **MSS Server (DAAC).** The MSS Server is a SUN Sparc 20/50 workstation and has four primary functions:
  1) It hosts a Sybase database used to support the Ir1 Event Log.
  2) It provides configuration management support for science software at the DAAC.
  3) It hosts the Communications Gateway and Data Server interface.
  4) It supports the M&O activities of the operations staff. This platform provides the user interface for system management and DAAC performance monitoring capabilities.

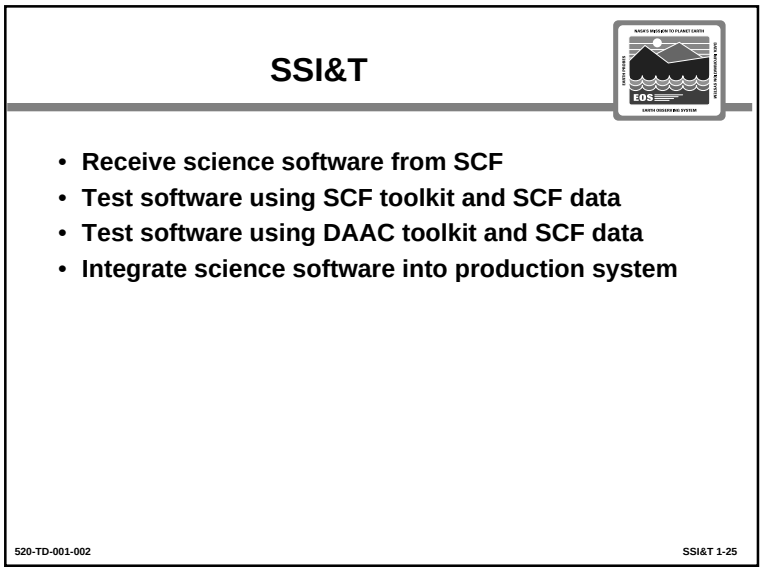
  At the GSFC DAAC, the MSS Server has a fifth function. It runs DCE Security and Directory server processes in "slave" mode. These processes are a backup to critical processes that run on the CSS Server at the EDF.



Discussion Topics

Ir1 main duties

- **Science Software Integration and Test (SSI&T)**. Ir1 provides an environment for the early integration and testing of science software from the EOS AM-1 instrument teams and TRMM's CERES and LIS instrument teams. Early SSI&T gives the instrument teams, DAAC personnel and the ECS development team the ability to test the portability of the science software using test data provided by the instrument teams.
  - PGEs - Product Generation Executable
  - DPRs - Data Processing Request
- **Early TRMM Interface Testing**. Ir1 provides capabilities for early functional testing of TRMM-ECS interfaces among several facilities including the Sensor Data Processing Facility (SDPF), the TRMM Science Data and Information System (TSDIS), NOAA/ NESDIS, the Data Assimilation Office (DAO), and two DAACs - LaRC and GSFC.
  - Ir1 provides the hardware and software tools to perform various system management activities at the DAACs.

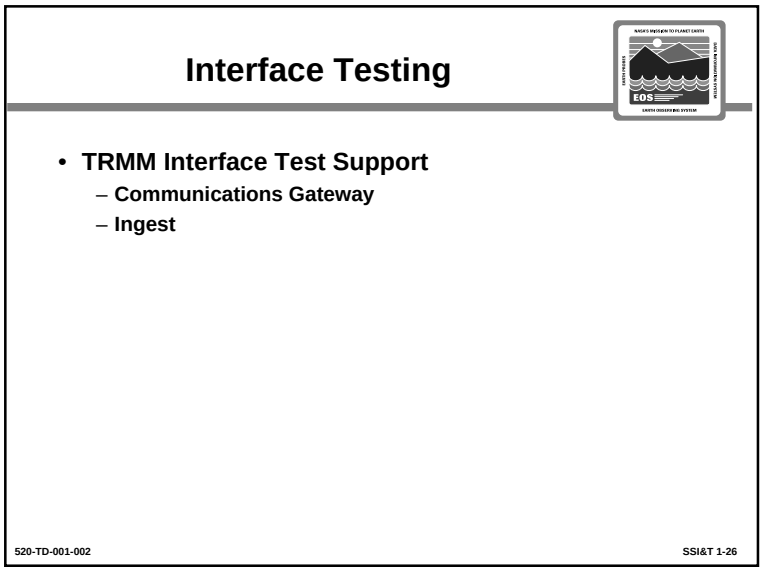


Discussion Topics

Discuss the interfaces between the DAAC and the SCF and/or developer. The DAAC receives science software deliveries from the SCF/developer. The DAAC and the SCF/developer work together during integration and test of the science software. During production, the DAAC may send data products to the SCF/developer for quality assurance and receive back quality assurance flags.

Science Software Integration and Test Support - The M&O staff at the sites are primarily responsible for the system administration activities needed to keep the IR1 system configured and up and running for the ITs to perform their tests. The DAAC Science and Engineering liaisons are primarily responsible for coordination of all testing activities with approval from DAAC management. The M&O staff will assist in testing at the direction of the ITs and Science Office personnel. Specifically:

- It is the responsibility of M&O to support the SSI&T at the DAACs as system administrators. However, the M&O staff will assist in the testing on a time available basis.
- The Science liaison receives all requests for resources from the ITs and DAAC management.
- All problems are screened by the M&O staff before they are forwarded to the development office.
- All tests performed by M&O will require detailed procedures.
- The M&O staff will assist the Science Office in the installation and configuration of all science software.



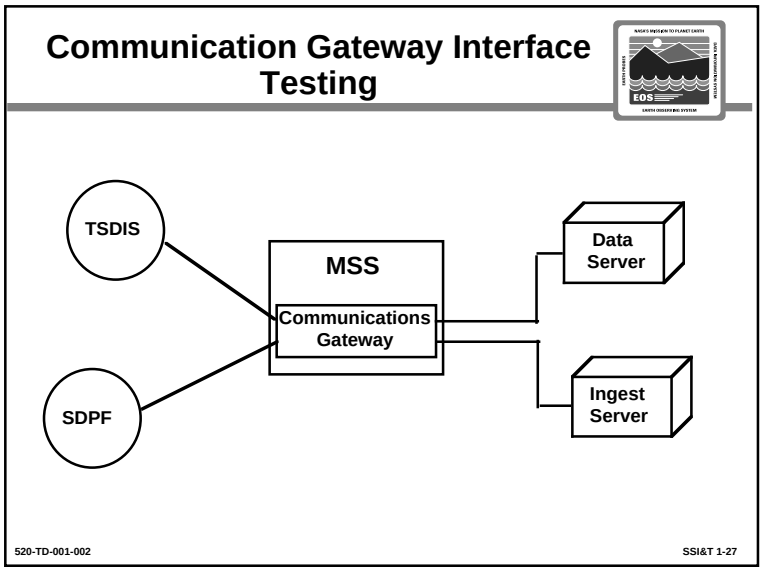
Discussion Topics

TRMM Interface Test Support. The ESDIS System Management Office (SMO) and independent verification and validation (IV&V) are primarily responsible for coordination of all testing activities with approval from DAAC management. The M&O staff will be responsible for executing the test with supervision from the ESDIS IV&V contractor and ESDIS SMO. The M&O staff will perform troubleshooting and problem reporting. Specifically:

- The interface testing is scripted by ESDIS SMO and the ESDIS IV&V contractor. They will determine the time and type of test. However, because of the limited functionality of IR1, this test will be restricted to receiving data via the ingest server and verifying that the data has been placed and identified on the data server.
- All coordination with external interfaces will be the responsibility of ESDIS SMO.

Communications Gateway. The Communications Gateway Process runs on the MSS Server at the LaRC and GSFC DAACs. This process provides the software interface between external entities and the Ingest and Data Server interfaces. The Ir1 Data Server interface is imbedded within the Communications Gateway Process.

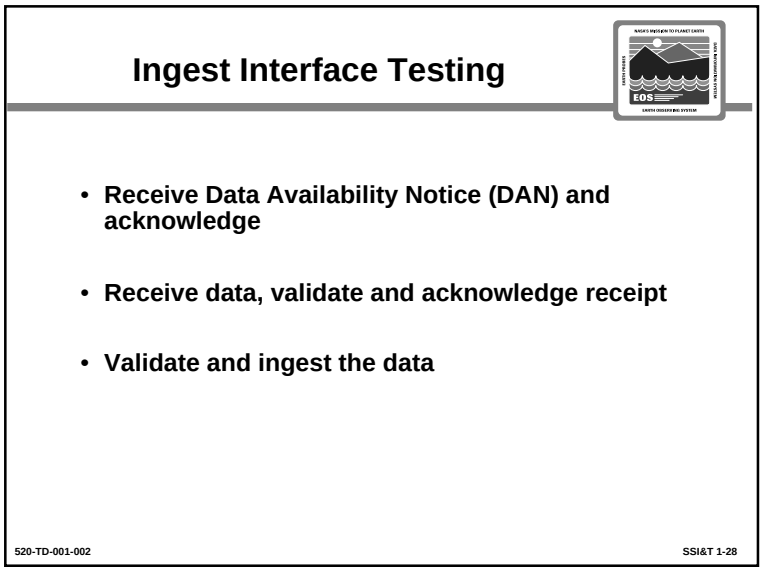
Ingest Interface. The Ingest Interface runs on the Ingest Server computer and processes requests to ingest data from external data providers. The Ingest Interface supports two kinds of interfaces, an Automated Network Ingest interface and a Polling Ingest interface. Both interfaces respond to valid ingest requests by transferring the data to be ingested onto the Ingest Server computer's local disk, by means of the ftp process.



Discussion Topics

Communications Gateway Process. Serves as the communications gateway for IR1 Data Server interface and IR1 Ingest Interface.

- Contains IR1 Data Server Interface
- Serves as the software interface between external entities and Ingest and Data Server interfaces
- Translates between UNIX sockets (TSDIS and SDPF protocols) and DCE services (Ingest and Data Server)
- Runs continuously on MSS Server, and is started automatically when MSS is started
- Requires DCE to run
- Operation of Communications Gateway Process is controlled (to some extent) by UNIX environment variables.
- Data Server Interface Configuration file controls the behavior of the Data Server Interface during testing (TBD)
- Data Server Interface processes data retrieval requests from external users and generates appropriate responses. When the Data Server Interface processes a valid data request, it sends the requesting entity the identity of a disk file which corresponds to the requested (test) data. The disk file resides in a directory known as the “ftp pull area”.



Discussion Topics

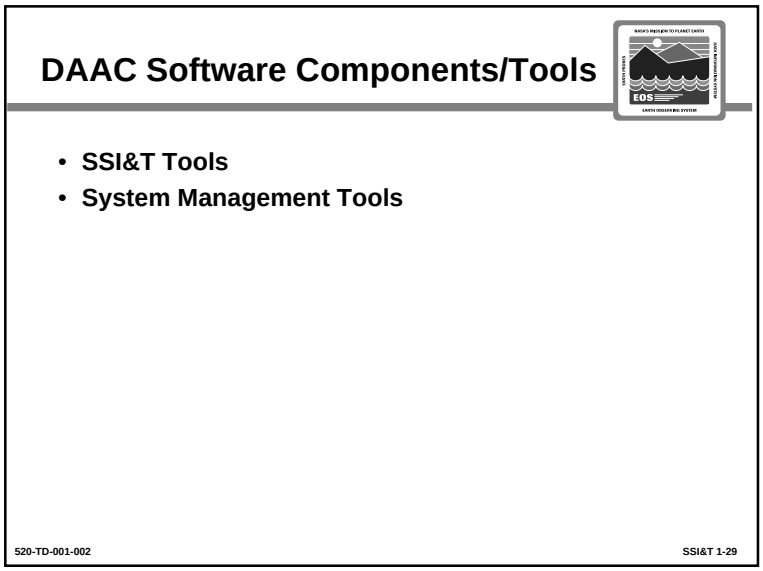
Test objectives. The objective of this test is to evaluate the ingest interface functions for the IR-1 system release by ingesting data. This includes:

- receiving and acknowledging the receipt of the Data Availability Notice (DAN)
- receiving, validating and acknowledging the ingest of the data; logging the receipt
- validation and ingest of the data; and initiating retransmission of the DAN or data, if necessary, due to a transmission or validation error.

This test will demonstrate the capability to transfer data for ingest over a Local Area Network (LAN) or Wide Area Network (WAN) or to ingest data via physical electronic media. There is no data archiving or data processing required for IR-1.

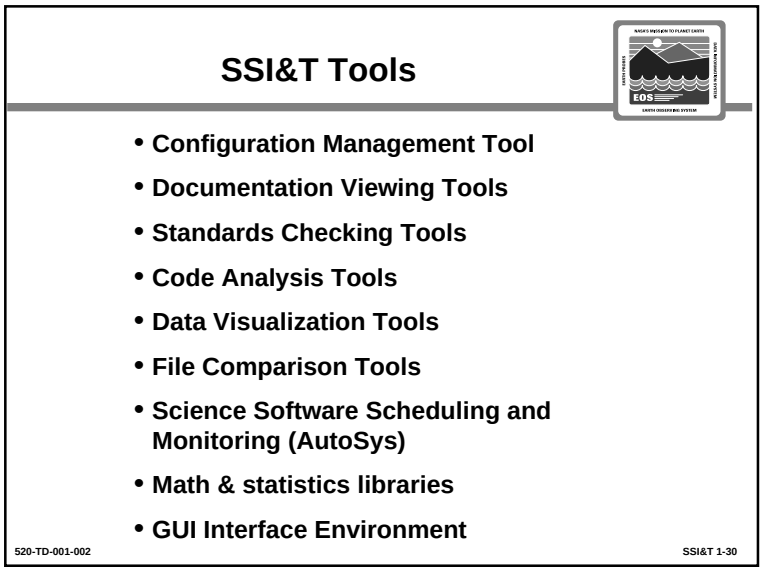
General test description. For IR-1, the ECS DAACs will interface with the TRMM Science Data and Information System (TSDIS), the Sensor Data Processing Facility (SDPF) located at the Goddard Space Flight Center (GSFC), and the National Oceanic and Atmospheric Administration's (NOAA) National Environmental Satellite Data, and Information Service (NESDIS) to ingest the following simulated data: TRMM L0, processed TRMM, metadata, ancillary and engineering, in Hierarchical Data Format (HDF), Common Data Format (CDF) or native format.

- To support the ingest interface testing, basic ingest services will be available at the GSFC DAAC and the LaRC DAAC. Interfaces not fully developed will be simulated.
- DANs are sent from the TSDIS, SDPF, and NESDIS to an ECS DAAC. The ECS DAACs receive the DANs and send a DAN receipt acknowledgment to the sender of the DAN. The data is then transmitted in either a data -driven (push) or schedule-driven (pull) mode to the ECS DAACs. The transmission is monitored for errors. After the data is successfully received it is validated by comparing it to the DAN as well as checking the header of the L0 data. If there was an error in the transmission or in the validation process a retransmission, up to a predetermined number of times, is initiated. When the data are successfully validated they are then staged and a successful data ingest acknowledgment is sent to the data provider.



Discussion Topics

This next section covers the tools used at the DAACs to test the science software and manage the system.



Discussion Topics

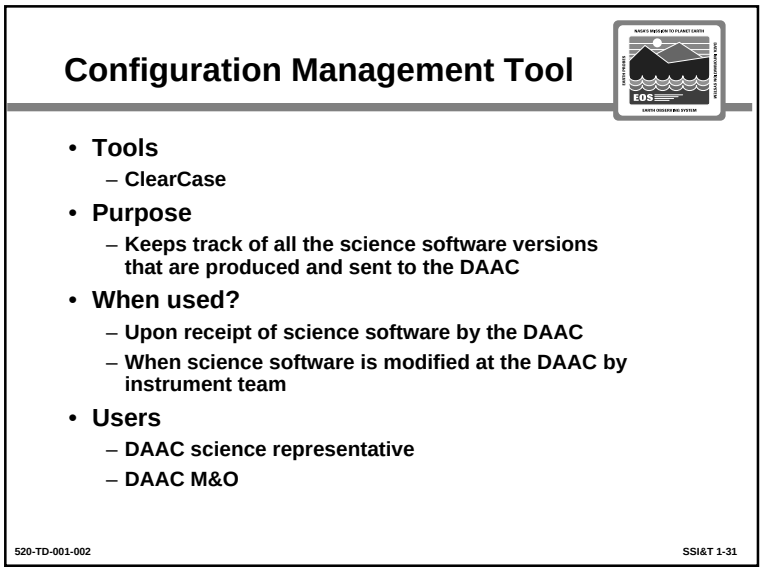
SSI&T Tools

Ir1 provides software tools to support the checking of science software at the DAAC, prior to the dynamic testing of the science software. These tools are known as the science software integration and test (SSI&T) tools.

The software that comprises the SSI&T tools is logically divided into the following categories:

- Configuration Management Tool - The Ir1 Software Configuration Management (SCM) tool is used to store and manage multiple versions of ECS custom software and science software and related science software files.
- Documentation Viewing Tools - The Documentation Viewing Tools are used for displaying and/or printing the science software documentation.
- Standards Checking Tools - The Standards Checking Tools are used for checking the science software to determine whether or not it follows prescribed coding standards.
- Code Analysis Tools - The Code Analysis Tools are used for checking the science software for ad-hoc analysis of science software, e.g. for detection of memory leaks..
- Data Visualization Tools - The Data Visualization Tools display input, output, and intermediate data files for diagnostic purposes. The tools display the files as data dumps, plots, and/or images.
- File Comparison Tools - The File Comparison Tools provide capabilities for displaying data files and identifying differences between files.
- Math and Science libraries are provided to reduce the programing requirements on the instrument teams at the SCFs.
- The system also provides a GUI environment to serve as a central launching mechanism for most of the SSI&T tools

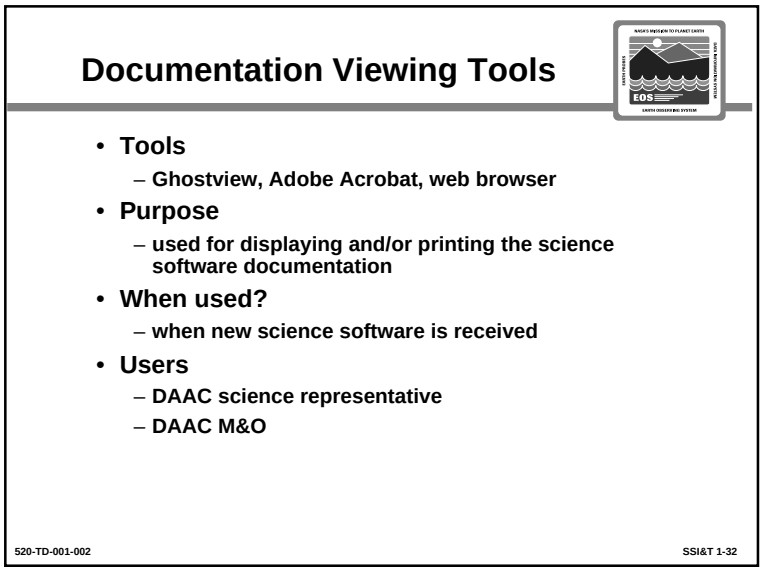
Note: These tools will be discussed in detail in subsequent lessons.



Discussion Topics

Configuration Management Tool. The Configuration Management Tool is designed to keep track of all the science software versions that are produced and sent to the DAAC.

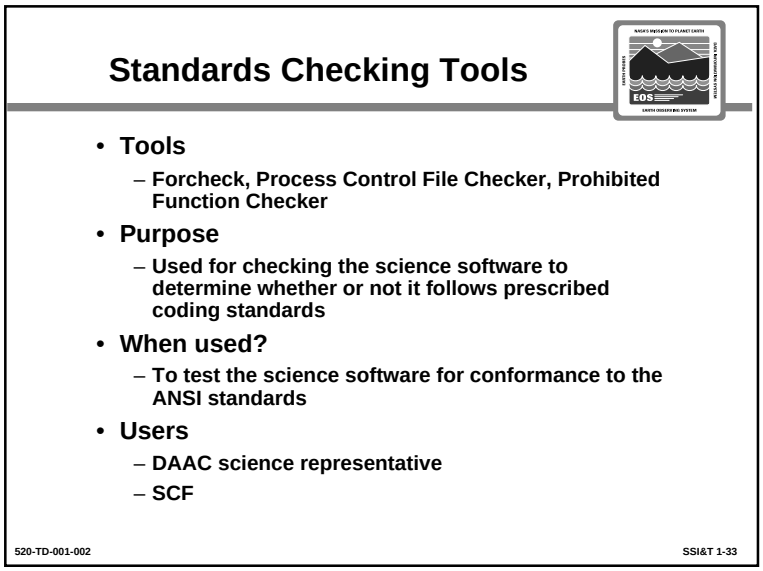
- The Configuration Management tool is: ClearCase



Discussion Topics

The **Documentation Viewing Tools** are used for displaying and/or printing the science software documentation.

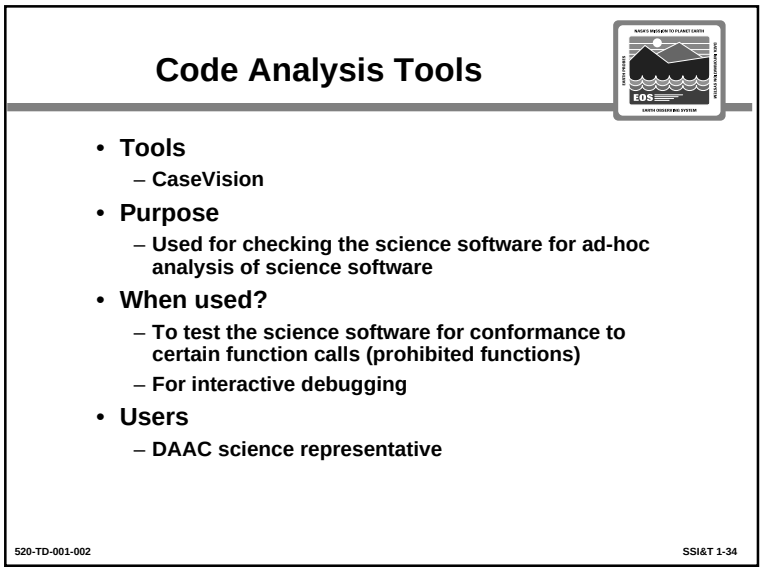
- The Documentation viewing tools are: Ghostview, Adobe Acrobat



Discussion Topics

Standards Checking Tools The Standards Checking Tools are used for checking the science software to determine whether or not it follows prescribed coding standards.

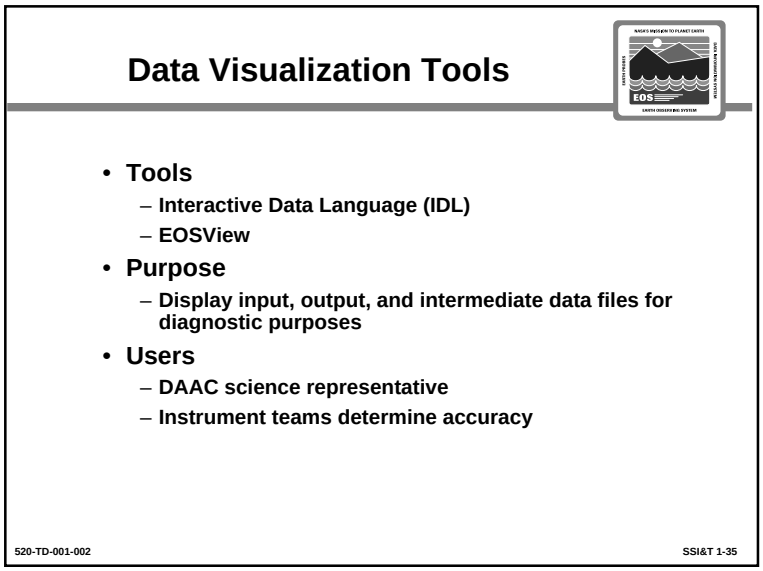
- The standards checking tools are: Forcheck, Process Control File Checker, Prohibited Function Checker



Discussion Topics

Code Analysis Tools. The Code Analysis Tools are used for checking the science software for ad-hoc analysis of science software, e.g. for detection of memory leaks.

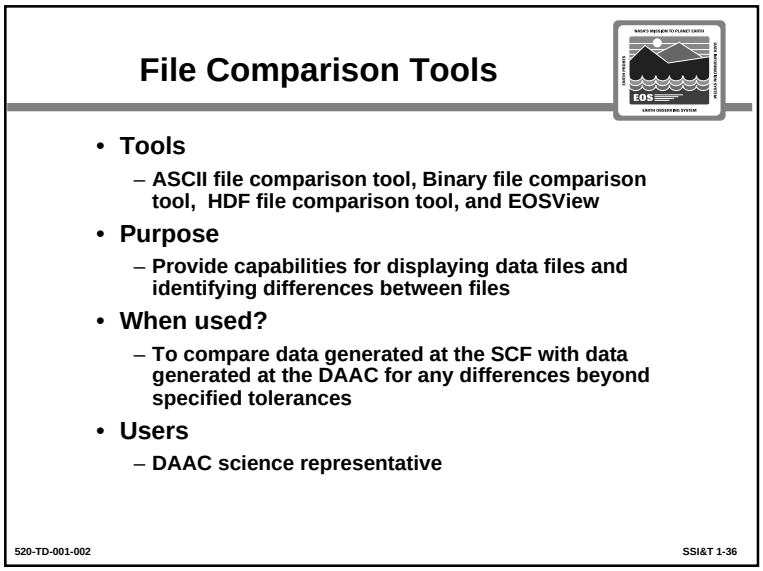
- The Code Analysis Tools are: CaseVision, SPARCWorks



Discussion Topics

Data Visualization Tools. The Data Visualization Tools display input, output, and intermediate data files for diagnostic purposes. The tools display the files as data dumps, plots, and/or images.

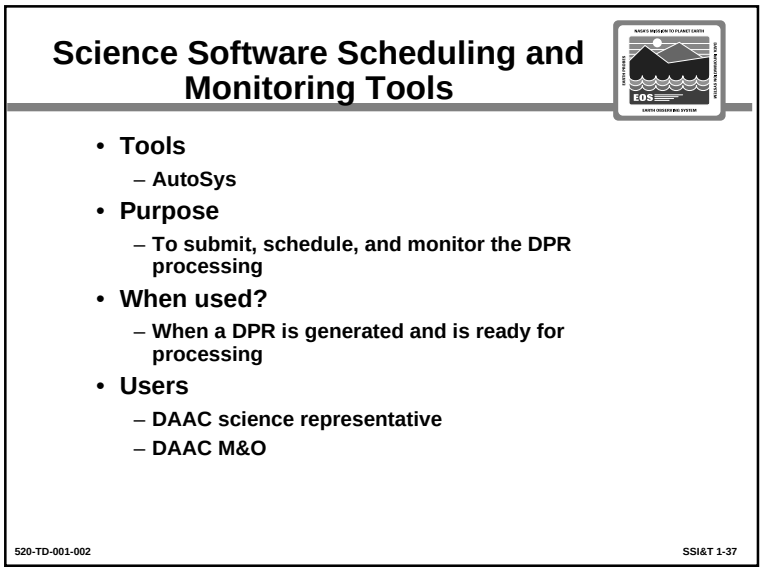
- The Data Visualization Tools are: Interactive Data Language (IDL) and EOSView



Discussion Topics

File Comparison Tools. The File Comparison Tools provide capabilities for displaying data files and identifying differences between files.

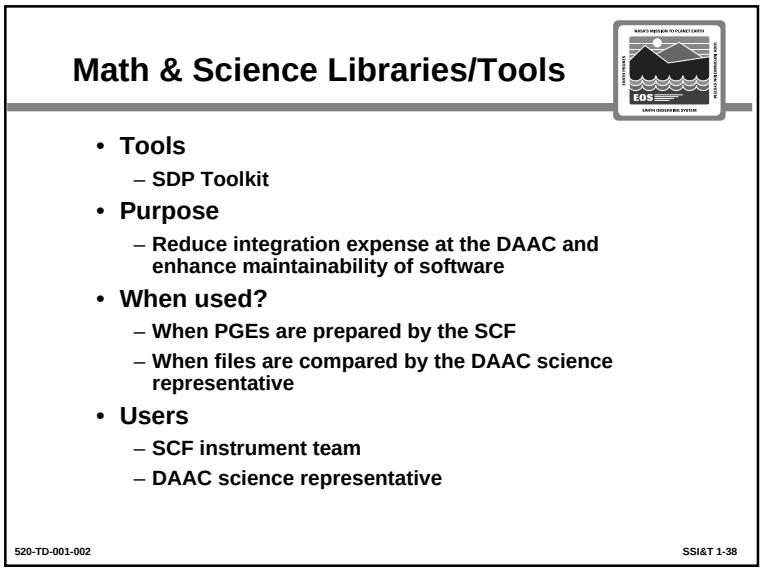
– The File Comparison Tools are: ASCII file comparison tool, Binary file comparison tool, HDF file comparison tool, and EOSView



Discussion Topics

The **Science Software Scheduling and Monitoring Tool** is used for launching the job and monitoring its execution status. It also provides the capability to prioritize jobs based on system resources.

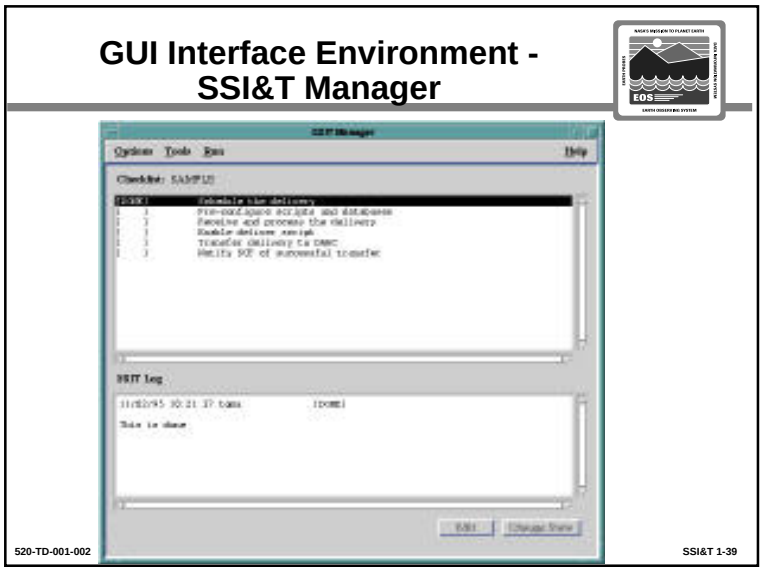
- The tool is: AutoSys



Discussion Topics

DAAC Science Data Processing (SDP) Toolkit is the DAAC version of the toolkit software supplied to instrument data processing software developers. The toolkit is the interface between science data processing software and the PDPS. The SDP Toolkit consists of a set of fully tested, fast, efficient and reliable C and FORTRAN language functions, customized for application to ECS.

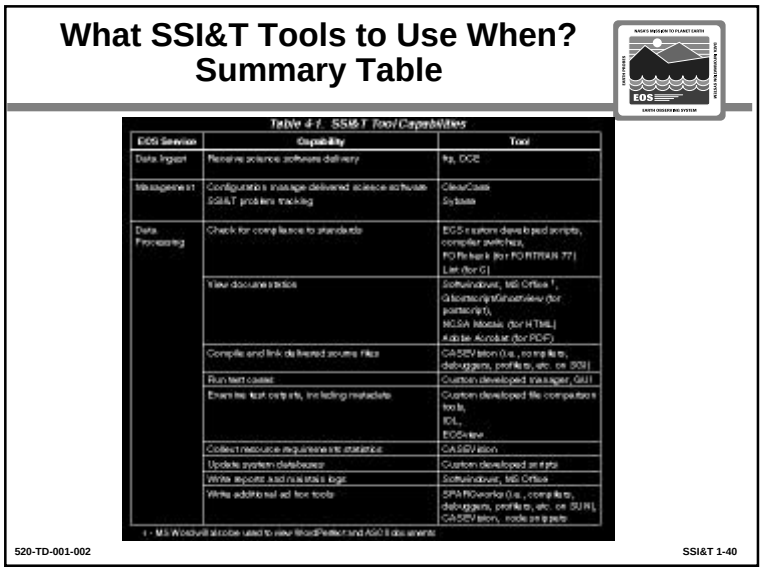
- It allows portability of science software across approved computing platforms at the DAAC and also from the Science Computing Facility development environment to the DAAC, and reduces redundant coding effort in the development environment.
- A goal of the Toolkit is reduced integration expense at the DAAC and enhanced maintainability of software.
- The current version of the Toolkit is specifically tailored for use at Science Computing Facilities. The Toolkit API (library calls in science software) will not change when the code is ported to the DAAC environment.
- The DAAC version will run on the DAAC SSI&T and science processing machines. This toolkit is a software library, consisting of several groups of custom developed code and COTS packages.



Discussion Topics

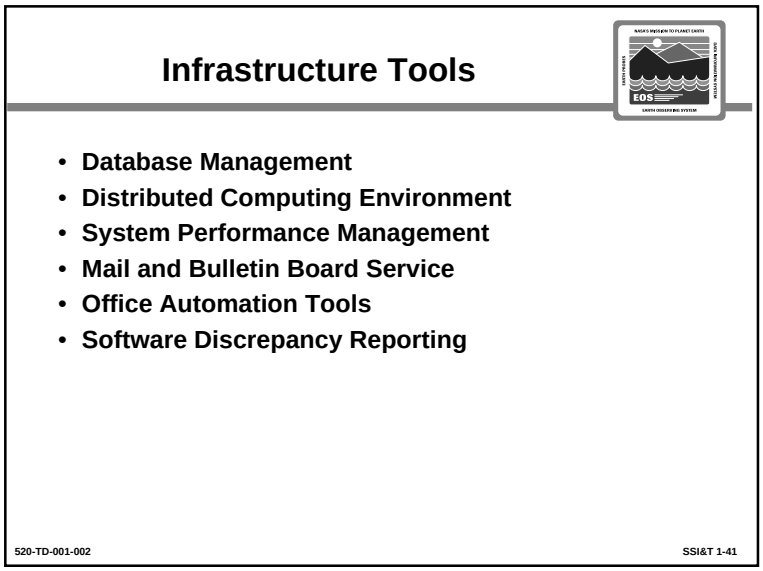
SSI&T Manager provides a common interface to the SSI&T software tools and manages their operations.

- **Documentation Viewing Tools** The Documentation Viewing Tools are used for displaying and/or printing the science software documentation.
  - The Documentation viewing tools are: Ghostview, Adobe Acrobat
- **Standards Checking Tools** The Standards Checking Tools are used for checking the science software to determine whether or not it follows prescribed coding standards.
  - The standards checking tools are: Forcheck, Process Control File Checker, Prohibited Function Checker
- **Code Analysis Tools** The Code Analysis Tools are used for checking the science software for ad-hoc analysis of science software, e.g. for detection of memory leaks.
  - The Code Analysis Tools are: CaseVision, SPARCWorks
- **Data Visualization Tools** The Data Visualization Tools display input, output, and intermediate data files for diagnostic purposes. The tools display the files as data dumps, plots, and/or images.
  - The Data Visualization Tool is: Interactive Data Language (IDL)
- **File Comparison Tools** The File Comparison Tools provide capabilities for displaying data files and identifying differences between files.
  - The File Comparison Tools are: ASCII file comparison tool, Binary file comparison tool, HDF file comparison tool, and EOSView



Discussion Topics

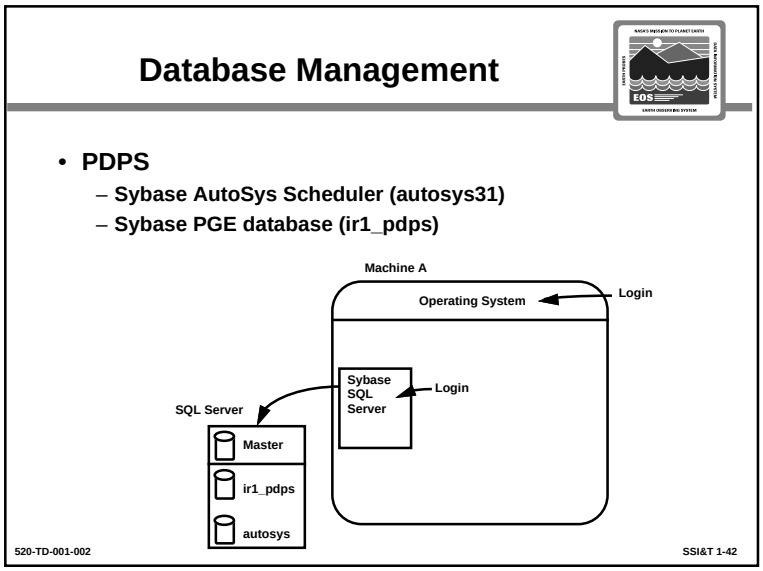
The table on the slide provides a summary of the tools for Data Ingest, Management and Data Processing.



Discussion Topics

Infrastructure Tools. IR1 provides an early implementation of communication and system management services in order to support evaluation and validation of the ECS communications and management infrastructure. The main tools are used for:

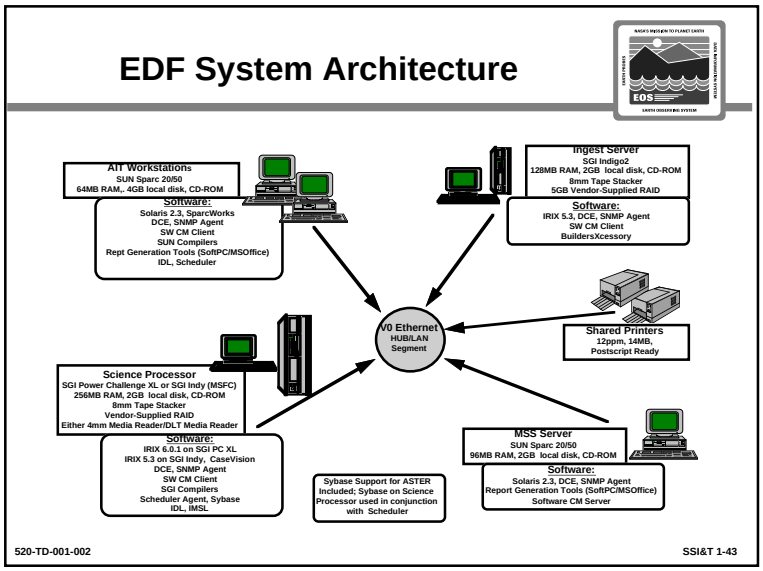
- Database Management
- Distributed Computing Environment
- System Performance Management
- Mail and Bulletin Board Service
- Office Automation
- Software Discrepancy Reporting



Discussion Topics

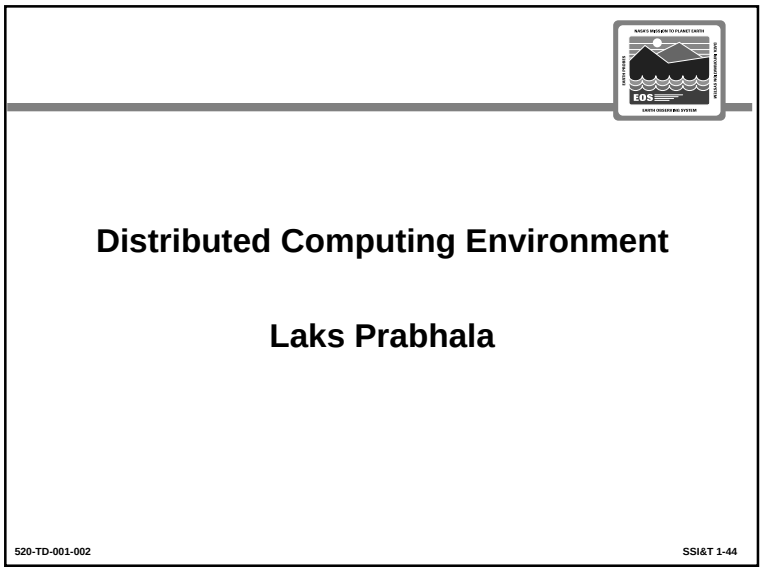
The Planning and Data Processing Subsystem utilizes two Sybase databases which reside on the Database Server computer. One database is used by the AutoSys scheduler product; the other database is the PGE database used by custom applications. Both databases are managed by a single Sybase SQL Server. A Sybase SQL Server is a set of one or more cooperating processes that manage one or more databases and provide database access to multiple users.

- The Sybase name for the AutoSys database is **autosys31**; the name of the PGE database is **ir1_pdps**. The Sybase System Administration Guide provides comprehensive information regarding Sybase database administration. Chapter 14 of the AutoSys User Manual discusses database administration as it applies to the AutoSys database.
- At the EDC DAAC, ASTER will implement a third database on the MSS Server. This database will be managed by a second SQL Server. The ASTER database will be administered by the ASTER team and not by the ECS M&O staff.
- **Startup and Shutdown Procedures.** The SQL Server is started up automatically when the Database Server computer is started up. Likewise, the SQL Server is shutdown when the Database Server computer is brought to an orderly shutdown. Scripts are provided to allow the operations staff to effect the startup and shutdown of the SQL Server independently, without having to force the shutdown of the Database Server computer.
- SYBASE is the main DBMS used for ECS Ir1. All the science software versions are stored in SYBASE. In a later lesson, we will discuss in some detail the SYBASE schema/structure for the science software and other data that both the M&O and the science office may need to track . We will discuss how, where, and when the information gets stored, tracked and retrieved from SYBASE.



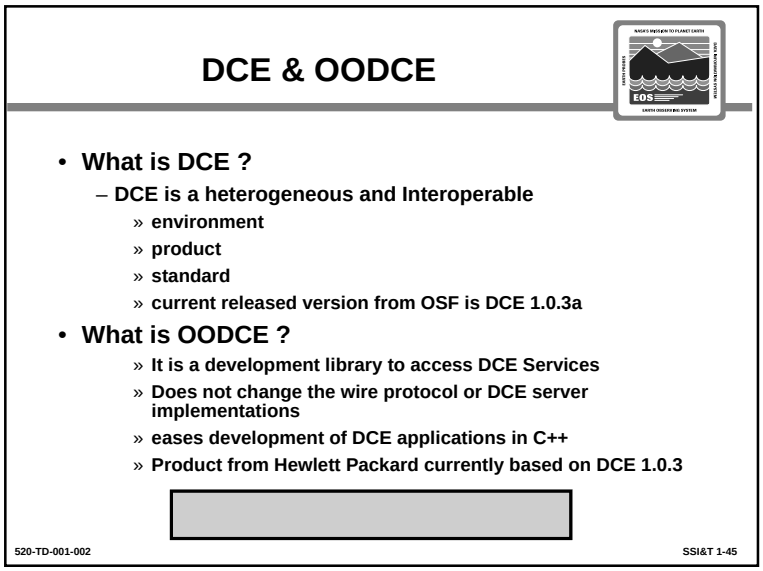
Discussion Topics

- **MSS Server (EDF).** The EDF MSS Server is an HP 755 computer. The primary function of this computer is to run OpenView and thereby provide system status and performance monitoring capabilities for each of the IR1 sites. The MSS Server also hosts the Communications Gateway and Data Server interface that are part of the TRMM interface testbed.
- **CSS Server (EDF).** The EDF CSS Server is an HP 755 computer. The primary function of this computer is to host the DCE Security, Directory, and Time server processes. The DCE Security and Directory server processes are necessary for the operation of DCE at all IR1 sites, but normally run at the EDF, only. The GSFC DAAC provides the capability to run backup Security and Directory server processes in the event that the EDF CSS Server fails.



Discussion Topics

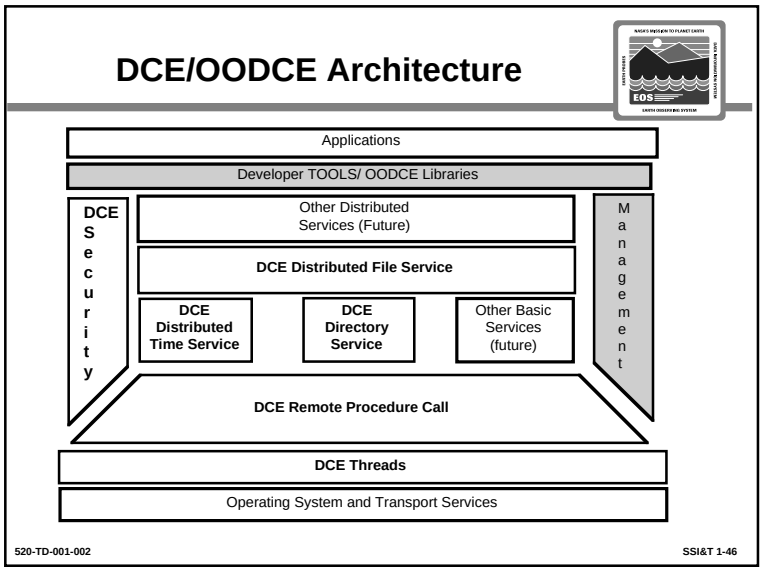
This section provides a brief overview of the infrastructure and services provided by IR1.



Discussion Topics

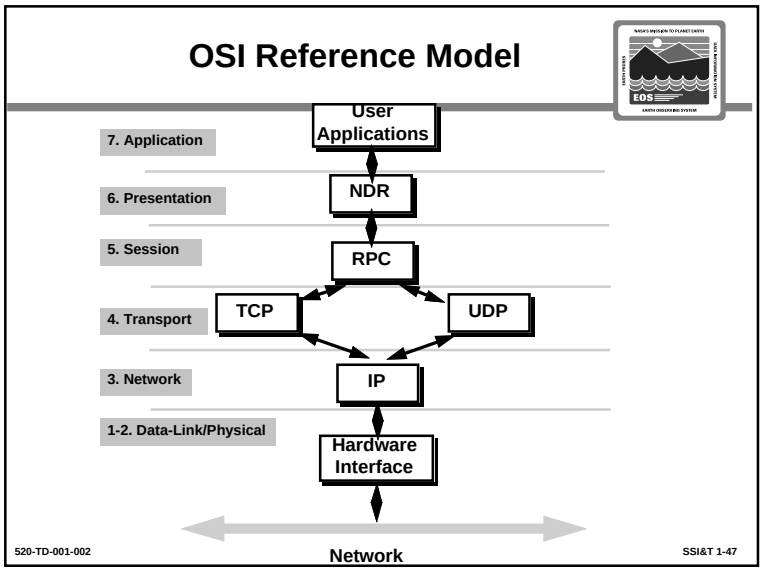
Distributed Computing Environment. A set of services that support the interaction of applications in a distributed computer system.

- DCE is administered as a collection of one or more cells. A DCE cell consists of a set of associated users, computers, and supporting resources. A cell establishes a security boundary between the users and resources within the cell and those outside of the cell. All of the IR1 computers and resources are encompassed by a single DCE cell.
- DCE is an environment because it have applications built on top of it (e.g. client, ingest); it is a standard because it comes out of OSF
- OODCE (object-oriented DCE) - it is not a standard now, but will be in the future
- DCE supports:
  - Inter-process communication between clients and servers
  - a Directory Service which allows distributed computers, peripherals, files, and users to be used and managed with a common location-independent naming system.
  - a Distributed time service which synchronizes the clocks in the various IR1 computers
  - a Security Service which controls access to resources and provides for secure communication
  - a Distributed File Service which allows users to store and access data stored in files located on remote computers.



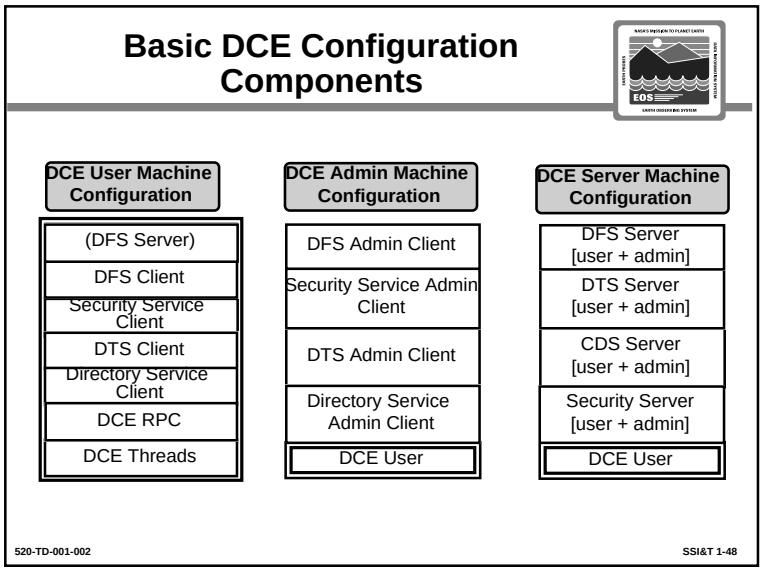
Discussion Topics

- Core services provided:
  - Remote Procedure Call - allows interprocess communication between clients and servers
  - DCE Threads - integral within all processes; helps do operations in parallel; sits on top of the operating system
  - Time service - synchronizes the clocks in the various Ir1 computers
  - Directory service - allows distributed computers, peripherals, files, and users to be used and managed using a common location - independent naming system
  - Distributed File Service is not used in IR1; in the future, it will allow users to store and access data stored in files located on remote computers
  - DCE Security - fully functional, supports authentication, authorization, data encryption, and privacy
  - Developer tools and OODCE libraries and applications can be built on top of DCE



Discussion Topics

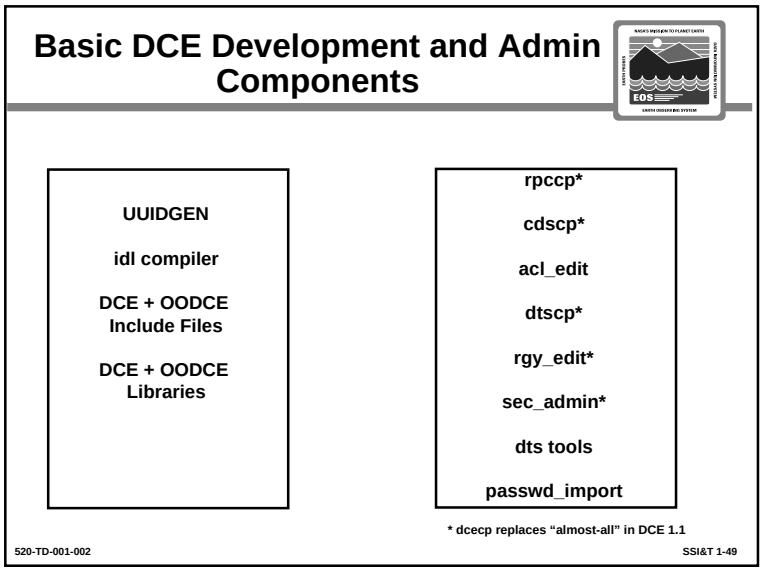
This graphic demonstrates where Remote Procedure Call (RPC) fits. RPC can run on both TCP and UDP. The application developer can select which protocol to use.



Discussion Topics

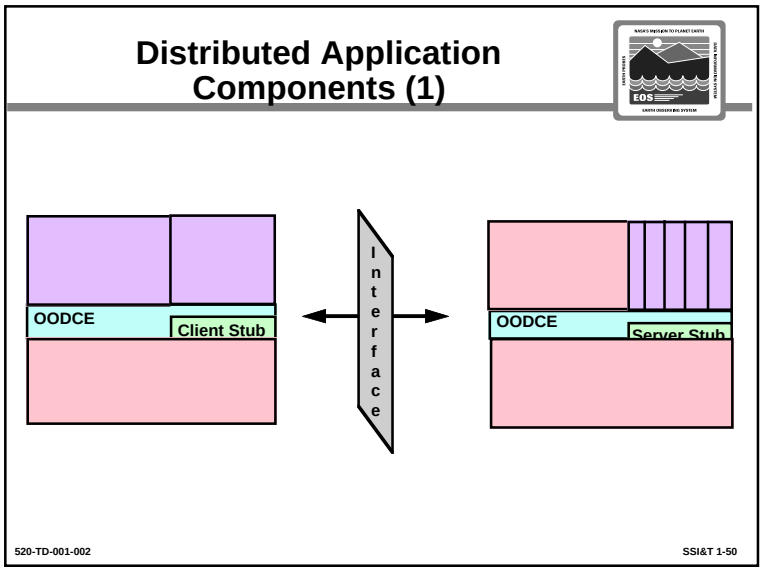
Every workstation in a DCE cell can be on one of the following:

- User
  - To run a client requires 4-5 Unix processes. Security Service, DTS, Directory Service, DCE RPC and DCE Threads are running in Ir1.
  - DFS Client is not running in Ir1
- Admin
  - DFS Admin Client, Security Service, DTS Admin Client, and Directory Service Admin Client are required tools
- Server
  - There are four servers running for DCE cells
  - IR1 will be running two cells (in case one breaks down)



Discussion Topics

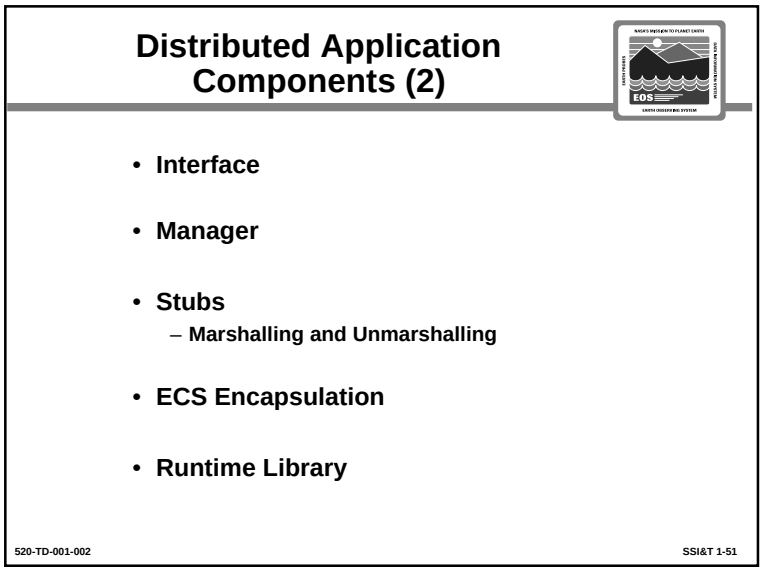
- Tools used by application developers (e.g. UUIDGEN calculates time and IP address/ guarantees a unique number for DCE)
- Admin tools (1.0.3 is version used for Ir1)
  - dcecp will be used in Release B



Discussion Topics

How the client talks to a server

- **Interface** is the most important - uses IDL (interface definition language) which takes care of all conversions between server and client. Input into IDL includes the name of the interface, input parameters, and expected results.



Discussion Topics

Interface

- Contact between a Client and a Server
- Client invokes the interface - Server guarantees to accept and process those invocations, returns results or raises exceptions

Manager

- Contains the actual routines of RPC implementations

Stubs

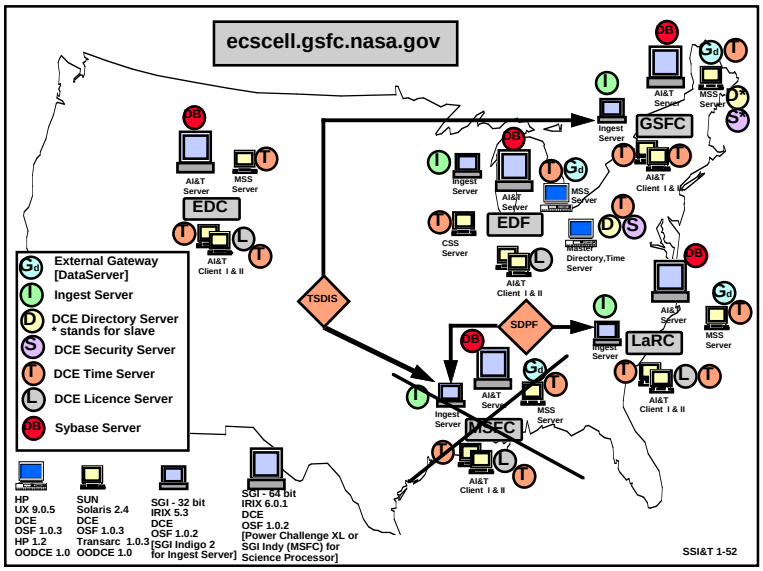
- Marshalling and Unmarshalling
  - translating RPC's parameter and results to and from a machine native format into a Common format transfer across the wire

ECS Encapsulation

- Adding new functionality to DCE/OODCE ex: MSS interfaces/Logging

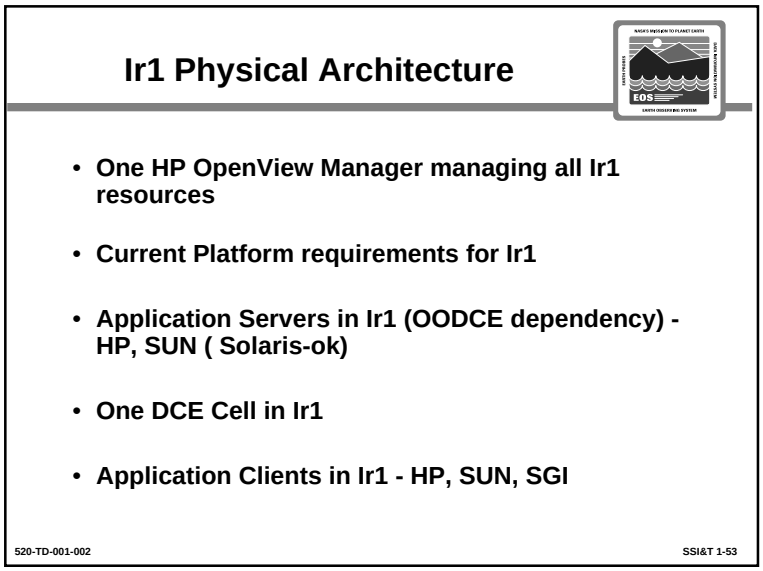
Runtime Library

- Interfaces all other DCE Services [security, directory etc..]



Discussion Topics

- There is one cell for all DAACs
- There are 3 timeservers at all DAACs
- GSFC runs replicate servers
- License server = DCE internal
- For given Ir1 cells, master = EDF



Discussion Topics

One HP OpenView Manager managing all Ir1 resources

- Installed at EDF and will have a map for each DAAC
- One Ir1 Map for a overall system monitoring and control
- Major Ir1 resource will have SNMP agent [Hosts, printers, routers]

Current Platform requirements for Ir1

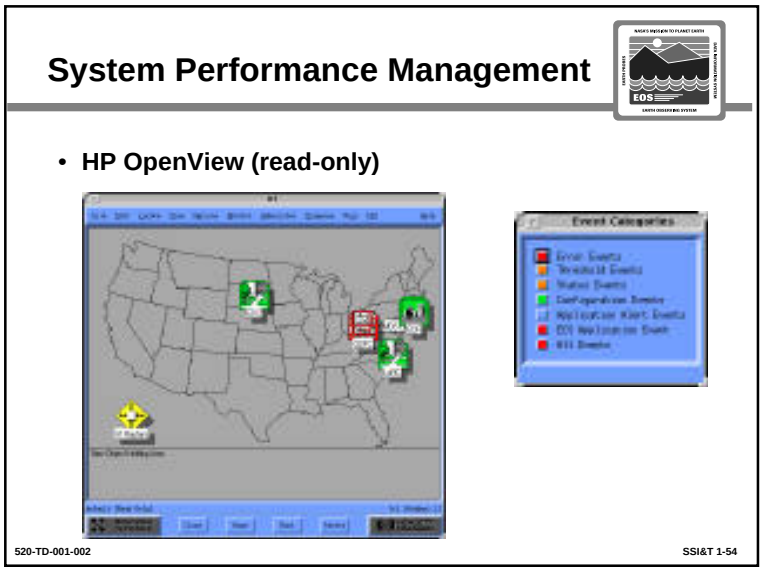
- HP, SGI , SUN (Solaris)

Application Servers in Ir1 (OODCE dependency) - HP, SUN (Solaris-ok)

One DCE Cell in Ir1

- Master Security and Directory services will be hosted on two workstations in EDF
- Slave Security and Directory servers will be hosted on one workstation at another DAAC [most likely at GSFC]
- Three time servers per DAAC and EDF
- Every Host in Ir1 will be a DCE client

Application Clients in Ir1 - HP, SUN, SGI



Discussion Topics

System Performance Management. MSS Server at the EDF will use the HP Openview for network monitoring while the DAACs will only have remote access, read-only

Purpose and Function. HP OpenView Network Node Manager is a multivendor network management application for use in managing TCP/IP network and network devices. Only one copy of the OpenView software will be installed, it will be on trevino.hitc.com, an ECS HP server in the Landover EDF. All OpenView software files reside on the EDF server, including files that are used for each DAAC's site display.

Major functions performed include:

- Mapping of the devices on the IR1 TCP/IP network and monitoring of the status of those devices.
- Diagnose network faults and performance problems from EDF for the IR1 network.
- Traps proactively alert the system administrator of changes that occur on the systems/devices.

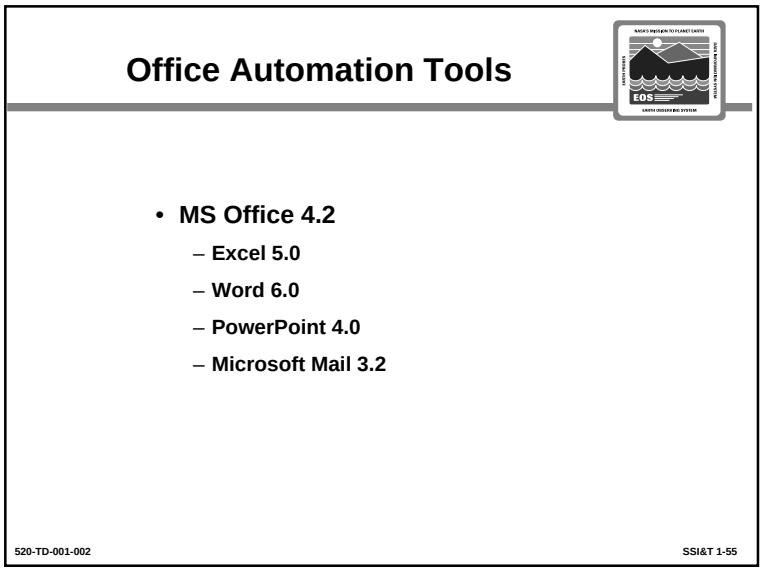
Dependencies

To allow the OpenView software to exchange queries and statusing of the DAAC elements, the V0 network must be up and operational at the DAACs. A hardware requirement of a 2 or 3 button mouse is necessary in order to access all available OpenView options while using the HP OpenView GUI .

OpenView Monitoring Values

The icons used by OpenView have a basic color code definition for reporting system hardware or software status. The color code means the same thing at all sites.

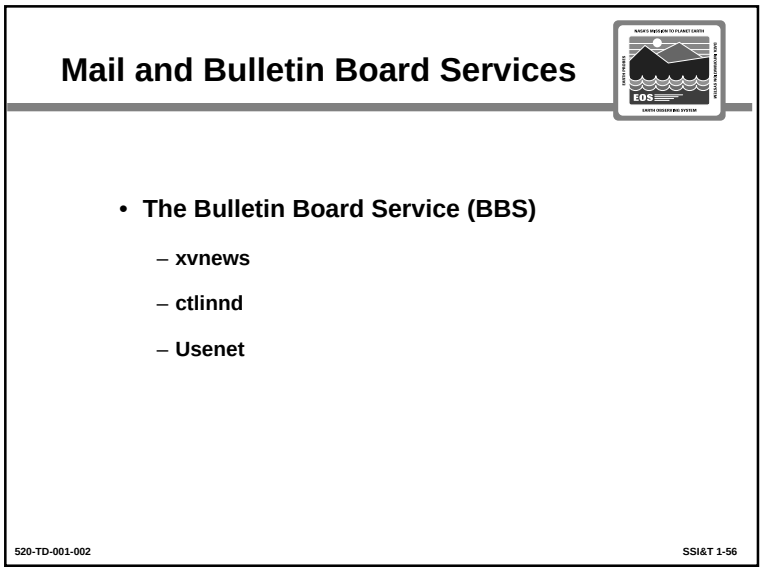
- Green - All devices underneath are operating normally.
- Blue - One element or component is operating in a warning/degraded condition.
- Yellow - Multiple elements or components are operating in a warning/degraded condition.
- Orange - One symbol is operating normally, all the rest are reporting abnormal conditions.
- Red - Element or component represented by the icon is down, off line or otherwise inaccessible to the reporting OpenView manager.
- All non-active option commands will be shown in a grayed-out mode.



Discussion Topics

The MS Office Standard version 4.2, software package contains the following office automation tool packages:

- **Microsoft Excel 5.0** - is the number processor in the Office suite. It is a spreadsheet application for judging and calculating numeric information. Excel is often used as a way to maintain information in tables that have no built-in computations.
- **Microsoft Word 6.0** - is a widely used word processor application. Word lets you enter, edit, format and arrange text, and it lets you automate many parts of the process.
- **PowerPoint 4.0** - has features that let you draw and graph and enter text on your slides, and it readily accepts tables, charts and clip art from other applications.
- **Microsoft Mail 3.2** - Send what you're working on directly from Microsoft Excel, Word or PowerPoint through your existing Mail server. It is the electronic mail system for PC networks.

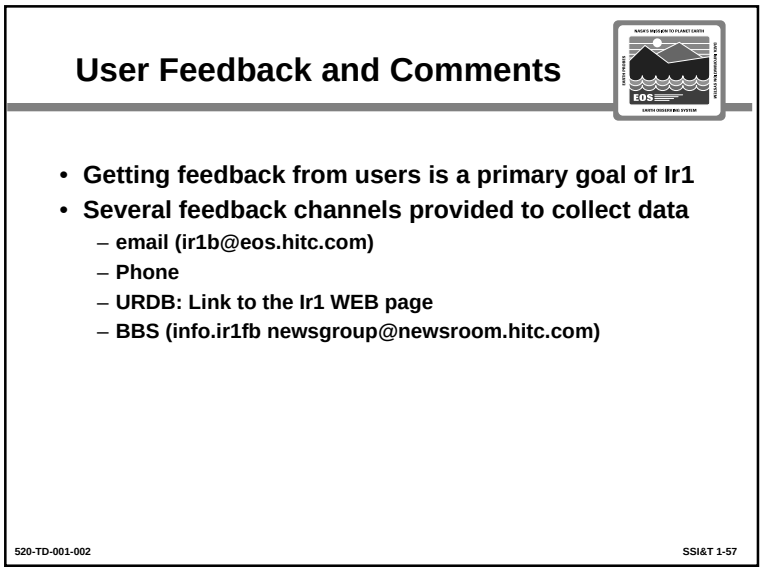


Discussion Topics

The Bulletin Board Service (BBS) supports a capability for sharing information, among IR1 users, testers, and operations staff.

- The **xvnews** program is provided which allows users to read, store, send, and print Usenet news articles. News articles are organized within named "newsgroups".
- The Bulletin Board Service provides the **ctlinnd** control program for adding and deleting newsgroups and for restricting access to IR1 newsgroups. The **xvnews** program provides the user the capability to list available newsgroups**.**
- The IR1 Bulletin Board Service utilizes communications software that resides on the Bulletin Board Server at the EDF. This software receives and scans news from external news providers (**Usenet**), and transmits news articles to external providers as required.

- Maintenance and Operations associated with the BBS is an EDF responsibility.



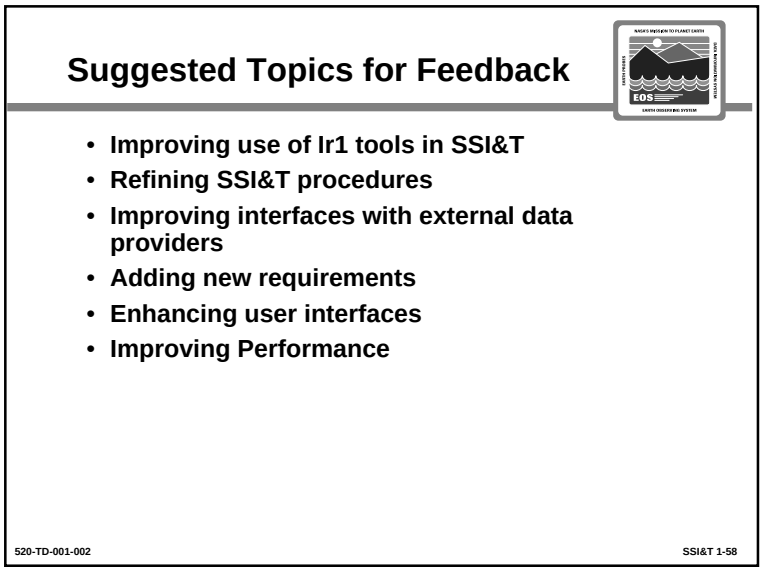
Discussion Topics

Getting feedback from users is a primary goal of Ir1.

This feedback will be provided directly to the subsequent release teams for further assessment and action.

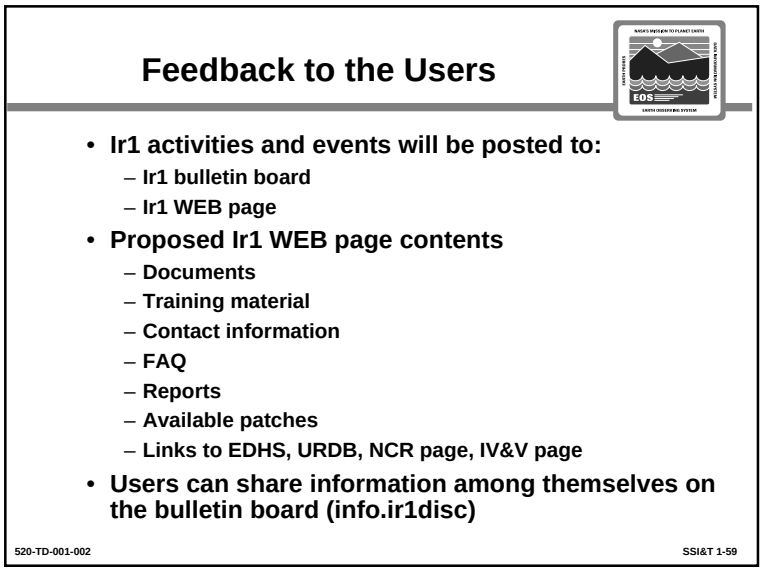
Several feedback channels provided to collect data.

- email: free form comments and suggestions from the community to ir1b@eos.hitc.com
- Phone: Call any member of the sustaining engineering staff
- User Recommendations Database (URDB): Link to the Ir1 WEB page
- BBS: post comments (info.ir1fb newsgroup@newsroom.hitc.com)



Discussion Topics

- Suggested topics for feedback
  - Improving use of Ir1 tools in SSI&T (e.g. file comparison tools, GUI SSI&T Manager)
  - Refining SSI&T procedures defined in DID 609 (reference manual for IR1), DID 611 (standard operations for M&O in Ir1), and the “Green Book” which untested SSI&T procedures that will eventually be incorporated into the 611.
  - Improving interfaces with external data providers - science teams will provide test data, but will also need ancillary data; won’t be testing but will look at how the interface works
  - Adding new requirements (as needed)
  - Enhancing user interfaces
  - Improving Performance - not the science software goal, but looking for the ECS performance to work well so that science is not affected
- The number one goal of IR1 is “lessons learned”



Discussion Topics

- Ir1 activities and events will be posted to:
  - Ir1 bulletin board
  - Ir1 WEB page
- Proposed Ir1 WEB page contents
  - Documents
  - Training material
  - Contact information
  - FAQ
  - Reports (statistics, metrics, response times, NCR status)
  - Available patches
  - Links to EDHS, URDB, NCR page, IV&V page
- Users can share information among themselves on the bulletin board (info.ir1disc)